SIXTY-NINTH YEAR

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NUMBER 3.

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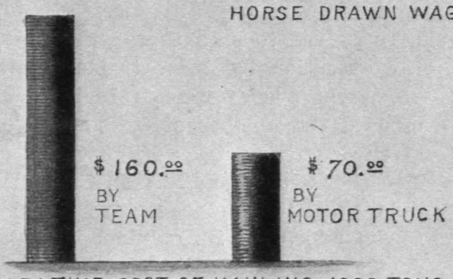
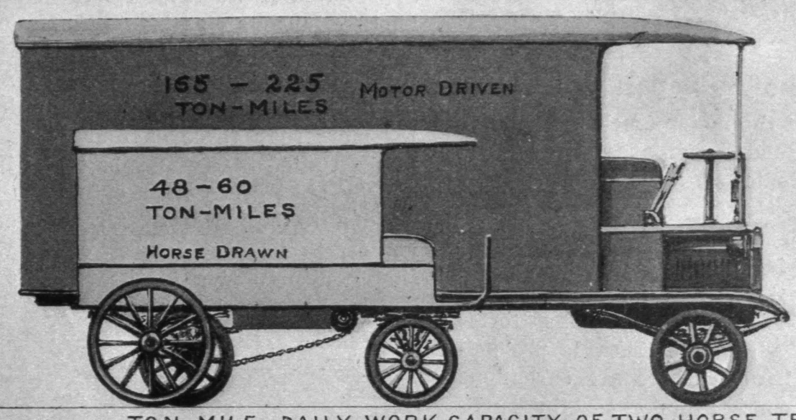
16 — 20 MILES
AVERAGE DISTANCE COVERED BY TEAM AND WAGON IN A DAY

40 — 60 MILES
AVERAGE DISTANCE COVERED BY MOTOR TRUCK IN A DAY

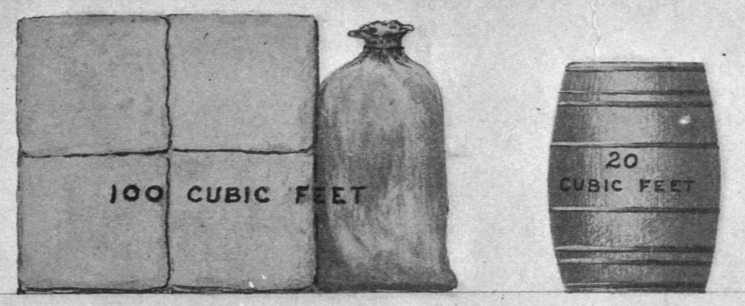
COMPARATIVE AREAS
SERVED DAILY BY MOTOR WAGONS AND HORSE DRAWN WAGONS



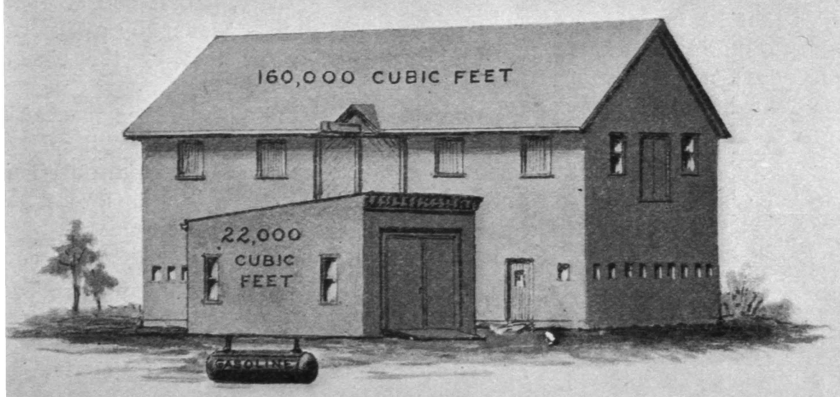
COMPARATIVE COST OF HAULING 1000 TONS TEN MILES



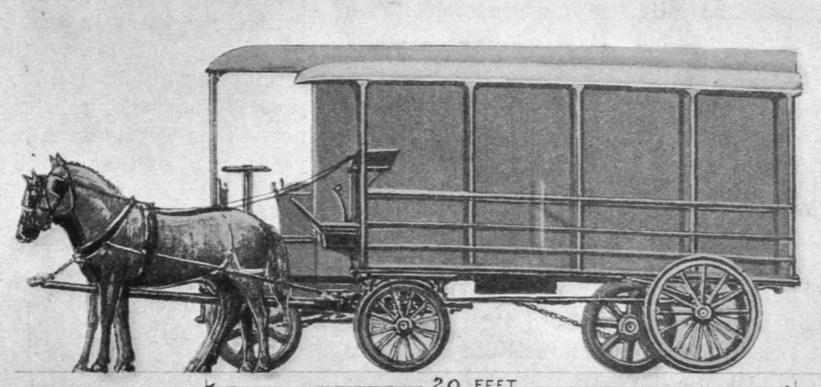
TON-MILE DAILY WORK CAPACITY OF TWO HORSE TEAM AND 3 TO 5 TON MOTOR TRUCK COMPARED



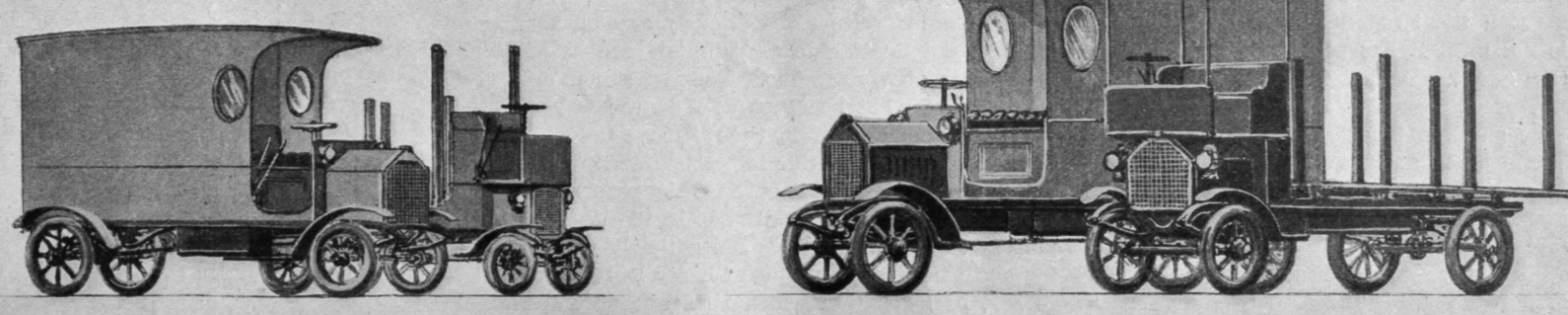
BALED HAY AND OATS — GASOLINE
COMPARATIVE SPACE REQUIRED FOR STORAGE OF TEAM FEED AND OF GASOLINE FOR ONE MONTH



COMPARATIVE SIZE OF STABLE FOR 100 TEAMS, 50 WAGONS, FEED AND HARNESS AND OF GARAGE FOR 15 MOTOR TRUCKS TO DO AN EQUIVOLENT AMOUNT OF WORK = FUEL STORED UNDERGROUND



COMPARATIVE LENGTH OF TEAM AND WAGON AND 3 TO 5 TON MOTOR TRUCK



COMPARISON OF MOTOR TRUCKS AND WAGONS IN USE IN AMERICA.
IN 1911 THERE WERE 25,000 AND AT THE END OF 1912 ABOUT 50,000

THE GREATER EFFICIENCY OF THE MOTOR TRUCK AS COMPARED WITH THE EFFICIENCY OF A HORSE-DRAWN WAGON.

[See page 66.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Comparing the Incomparable

IN the earlier years of the motor truck the relative efficiency of electric and gasoline driven vehicles formed a common topic of discussion. To-day, such partisanship has practically ceased, for it is generally realized that each type has its own distinct sphere of service, and it is useless to pit one against the other when they do not run parallel courses. Generally speaking, the electric truck excels in territories of small radius, while the gasoline truck is pre-eminently adapted for long hauls. There are exceptions to this classification, of course; under certain conditions the gasoline truck can be used to advantage in a small territory and occasionally very long hauls are made with electric trucks. But, as a rule, large users of motor vehicles find it necessary and economical to use both the gasoline and the electric types.

In the present issue of the SCIENTIFIC AMERICAN, two motor truck comparisons are published, based on data from different sources, and they appear to be rather discrepant. One confines itself to comparing the motor truck with the horse, while the other goes a step further, and compares the gasoline with the electric wagon. At once the question arises where are the points of contact. The comparison is based on an exceedingly large number of observations, made by the Massachusetts Institute of Technology. These observations have been carefully tabulated, and it was found that the only unit common to all is the cost per mile of operation. The estimate of expenses has been very thoroughly summed up. It is distributed under four main heads, namely, the energy source, maintenance, garage or stable, and overhead charges. The investigators realized the difficulty of making their estimate. It was hard to judge the depreciation of a machine in the limited time during which the observations were taken. This could not be based on the work of old machines. The motor truck is still undergoing development and is constantly being improved, and no doubt new machines, although they have not yet shown their work are longer-lived than the older ones. Despite these difficulties the Institute has made a comparison, which we have translated into a picture on page 70. The result is startling indeed. It is remarkable that the horse is not so hopelessly outclassed, particularly for light delivery, as we had been led to believe by previous comparison. For half-ton parcel-delivery wagons, the horse-drawn vehicle costs only two cents per mile more than the electric, and it is actually two cents per mile cheaper than the gasoline vehicle. Even with the two-ton vehicle he holds his own, and it is not until it has passed the 5,000-pound mark that the gasoline curve intersects the horse curve. As we proceed toward heavier vehicles, it will be seen that the gasoline truck is gradually creeping up on the electric truck and leaving the horse-drawn truck far behind. In fact, it looks as if the gasoline curve would cross the electric curve somewhere between the six and seven-ton mark.

One important factor we have so far overlooked, namely, the extent of territory covered by the various types of trucks. This is a most important consideration. The Institute tells us that the territory covered in each case is assumed to be within four miles of the loading point. That at once explains the poor showing of the gasoline truck. The gasoline truck has been taken out of its element, to compare it with the other two types. Is it not like comparing a Marathon runner with sprinters over a one hundred yard dash?

In Defense of Brain Property

IN the hearings before the Committee on Patents, held to receive the views of inventors and manufacturers on the Oldfield Bill, which seeks among other things to compel a patentee to grant licenses under certain conditions, the fact that the American patent system, since its foundation, has given to the public—as distinguished from the patent owner—greater advantages in profiting from inventions than the public has ever had or ever seriously demanded has been completely overlooked. That the benighted constitution makers one hundred and twenty-five years ago could actually have tucked into that reactionary document a piece of the most up-to-date "public ownership" idea, by fixing a "limited period" for the private ownership of an invention, is a notion still so novel that it is hardly to be wondered at that statesmen who have ceased to read the Constitution should entirely miss it. Labor agitators are loudly demanding that the laborer shall own the thing that he produces. That is exactly what the Constitution granted to the inventor; for the inventor is actually allowed to own for limited periods the thing that he created. Why then reduce to nothing the single successful socialistic property institution in our Government?

The full significance of the reactionary measure that Mr. Oldfield would like to see enacted into law, can be appreciated if we translate the terms of his bill into another language, as it were. If Congress should solemnly determine that if anyone permits his real estate to go unimproved, his houses to remain unoccupied, his horses to stand idle, or his clothing to hang unworn for more than three or four years, then anyone else in the United States may hail him into Federal Court, and by legal proceedings extort the unconditional permission to build on that real estate, to occupy the houses, to use the horses, or to wear the clothing, simply upon paying to the unfortunate owner a sum which the court, after some guessing, "deems just," we would have almost an exact parallel to the doctrine that Mr. Oldfield seeks to engraft upon our patent system.

The purpose of the patent laws of the United States seems to have been ignored. What does the public demand? Simply disclosure of the invention and the right to enjoy it unrestrictedly after the lapse of a certain period. If the limited monopoly that the inventor now receives is curtailed in the manner proposed, we may expect to find manufacturers refusing to take out patents and endeavoring to keep their processes secret.

Indeed, even the present patent system is not quite liberal enough for some inventors. Dr. Baekeland testified before the committee that a well known photographic paper that he once manufactured is still made by a secret process, and Mr. H. Ward Leonard, a distinguished electrical engineer and inventor, stated that certain enamelling processes of his were not patented, but were carried out in secret. The inventions of both men are valuable; yet it is doubtful if the public will ever enjoy them in the manner contemplated by the present patent laws. Sir Henry Bessemer, in his fascinating autobiography, tells us that he invented a process for making bronze and gold powders, which process he kept secret, we believe, for a number of years. Out of that secret process he made the fortune which afterward enabled him to engage in the costly experiments that eventually gave the world Bessemer steel. If the English patent laws had been somewhat more liberally framed, Bessemer would not have been allowed to enjoy a monopoly which unquestionably deprived the public of a great right.

The Block Signal and Control Board

IN view of the present widespread public interest in the subject of safe railroad travel, we direct attention to the fourth annual report of the Block Signal and Train Control Board, a document which should be in the hands of every one who is giving or about to give practical attention to this matter. Copies can be obtained either gratuitously or at a very small price on application to the Superintendent of Public Documents at Washington. The report not only gives a *résumé* of what has been done in the way of either encouraging or compelling the railroads to install safety appliances; but (and this is perhaps even more important and illuminating) it outlines the proper attitude of the Government to the railroads in the matter of compulsory legislation, and sounds a timely note of warning as to the inadvisability of hasty legislation, that is to say, of legislation which runs ahead of the actual state of the art, particularly as regards the question of automatic train stops.

Let it not be supposed from what we have said above that the claim of the railroad officials made at the recent investigation of the Westport disaster in this city, that there was no practicable train stop in existence, is warranted by the facts. For several years past the Board has been carrying on exhaustive tests on automatic stops which in its judgment gave promise of being of practical value. Speaking of these tests, the report says: "The information obtained from tests, together with knowledge of the general state of development of the art of automatic train control, leads the Board to conclude that there are several types of apparatus and methods of application which, if put into use by the railroads, would quickly develop to a degree of efficiency adequate to meet all reasonable demands." Yet the Board is perfectly fair to the railroads, for it says that it does not wish to be understood that the conditions of entirely acceptable automatic train control as formulated by it in the ten characteristics published in its report (see page 67 of this issue) are fully met by any one of the devices it has thus far examined. In the opinion of the Board the art of automatic train control is "still largely in the experimental stage;" but it considers that it is far enough advanced to warrant the installation of available devices with a view to their further development to meet the demand for safety in train operation.

It is well understood by those of us who keep in touch with railroad matters that, hitherto, the railroads have not only failed to show any disposition to encourage the invention and development of the automatic stop, but that they have been, in most cases, strongly averse to it. This opposition certainly cannot be due to a belief that the production of a satisfactory device of this character is mechanically impossible; for the mechanical or electrical elements involved are not materially different from those used by the railroads in the every-day operation of their interlocking and block signals, train brakes, and other devices. The average railroad management is desirous of getting the largest amount of traffic possible over its lines in the shortest possible time, and, incidentally, of doing this with the least amount of risk either to rolling stock or passengers and employees. But unfortunately, there is a tendency to slight the second consideration in favor of the first. Certainly the cry of "safety first" has *not* been the ruling principle in railroad operation; and the Board is perfectly justified in its opinion that "the question of the actual design and construction of the apparatus necessary for automatic train control system has not been as great an obstacle in the way of its adoption as the operating question involved in its use."

The independent inventor, working outside of the railroads, has done his part and done it well in producing several promising designs for automatic train control on steam railroads. The automatic stop has been proved to be a thoroughly practical device under the exceptionally dense traffic of the New York subway, where so far from limiting, it has greatly increased the number of trains that can be run over a given length of track in a given time with safety. The Block Signal and Train Control Board has shown, by test, that there are stops suitable for steam railroads, which, in its opinion, if installed and actively developed by the railroads themselves, would soon be brought to a point at which they would satisfy all requirements of daily operation. Furthermore, there is just now great activity, expert and otherwise, being shown in this field, and undoubtedly additional devices will be forthcoming for test by the Train Control Board.

It is evident that the question has reached the point where it is distinctly "up to" the railroads, and upon their attitude alone will depend the question of compulsory legislation by the Federal Government. It is certain that the railroads do not want compulsory legislation, and it is equally certain that they can prevent it only by a change of attitude and a sincere and earnest co-operation in meeting the unmistakable demand of the traveling public. The Board does not believe that at the present time legislative compulsion would be wise, but it does believe that the railroads should be urged and expected to develop the art of automatic train control, so as to provide devices which will meet their operating conditions. "This," says the report, "appears to the Board to be entirely practicable, *and should it not be done with a reasonable degree of expedition, steps should be taken by the Government to stimulate such action.*"

The case could not be more fairly stated; let us hope that this may prove to be that word to the wise which is sufficient.

Agriculture in the Congo.—Since the Belgian government has been carrying out active operations in the Congo region, one of the interesting features is the agricultural work which is being carried on there, and especially the attractive botanical garden and establishment located at Eala where observations are made upon the native plants. The area now in use is about 500 acres, of which 200 acres are devoted to the botanical garden proper. The personnel consists of 8 specialists including an entomologist and a chemist, with 500 natives engaged on the premises. An annual fund of $30,000 is allowed.

Engineering

Installing Spillway Sluice Gates.—Several of the fourteen sluice gates required in the Gatun spillway have been put in position. These gates are massive structures of steel, 19 feet high by 47 feet 10¼ inches in length, each weighing 44 tons. They will slide vertically in steel grooves formed in the concrete piers which have been built above the crest of the spillway dam, and they will serve to regulate the height of Gatun Lake.

New York Erects Twelve Thousand Buildings.—During the past year some twelve thousand structures of various kinds were erected in New York. Were they all dwellings for single families, the sum of $207,000,000 expended would furnish sufficient homes for a city of about 60,000 people. In Manhattan the sum of over $116,000,000 was invested in the construction of buildings. During the year, over $30,000,000 was expended on office buildings alone.

Diesel Marine Engines of 24,000 Horse-power.—It is authoritatively stated that the German navy is having constructed a twin-screw Diesel marine engine, which will consist of two sets of six-cylinder, double-acting engines, each set giving 12,000 horse-power, or 2,000 horse-power per cylinder. To those who have closely followed developments, this information will cause no surprise; for the Germans have been making wonderful strides in the construction of oil engines of large size.

New Gyroscopic Compass a Success.—A board of naval officers appointed to test the new gyroscopic compass, which was installed experimentally on the destroyer "Worden," have found it to be remarkably free from oscillation due to the rolling and pitching of the vessel. Experiments which have been made with the same compass aboard a submarine show that it enables a helmsman to steer a more accurate course when the vessel is submerged.

Turkey Sells Her Dreadnoughts.—All work has been stopped by Vickers, Ltd., of Barrow, on the construction of the Turkish dreadnought "Mahmed Reshad V." The vessel will probably be completed for some other power. A sister ship under construction by Armstrong will also find its way into some other navy. The Turkish cruiser "Drama," of 3,800 tons, has been sold to Italy for $1,000,000. There is no difficulty, in these days of feverish naval activity, in finding a ready market for warships.

A 10,000 Horse-power Transmission Gear.—A test has recently been made at the Vulcan Works, Hamburg, of a Föttinger hydraulic transmission gear of the great capacity of 10,000 horse-power. This is one of two transmission gears which are to be fitted on a new German liner. The plant underwent a continuous trial of two weeks' duration, night and day, under high load. The turbine shaft is designed to run at 850 revolutions per minute and the secondary or propeller shaft at 170 revolutions. The transmitter ran smoothly without noise or vibration; reversing took place rapidly; and the efficiency obtained was close upon 90 per cent.

A Sun-power Plant in Egypt.—At Meadi, a suburb of Cairo, is a sun-power plant of unusual interest. It consists of five reflectors, each 204 feet long, whose cross-section is in the form of a parabola, with the generator units at the focus. The last-named are of zinc, built of rectangular sections 14 inches wide. To render them efficient, they are painted with a black paint of high heat-absorbing capacity. The water is introduced at the lower end and the generator at its upper end is provided with a steam connection 4 inches in diameter. The reflectors are lined with silvered glass mirrors. The plant works best at a pressure slightly below the atmosphere.

The New Quebec Bridge.—The revised design for the Quebec bridge is so far advanced that details of the principal members are available. The main span is 1,800 feet long. The top chord members of the cantilevers will consist of double lines of 16-inch I-bars. The bottom chords will have the enormous dimensions of 7 feet height by 10 feet width. The length from panel point to panel point will be 86 feet; each full panel of the bottom chord for one truss will weigh 200 tons. Each cast iron base for the towers will weigh 500 tons. The stringers reaching from panel point to panel point are massive plate girders 10 feet in depth, each weighing about 60 tons.

The Essential Feature of the Diesel Engine.—In the course of a paper recently read by him at Berlin, Dr. Diesel denied that the essential feature of the Diesel process was the auto-ignition of the fuel. He stated that motors in which the auto-ignition of the fuel took place were in use before the Diesel process came into being; indeed, he had never laid a claim to auto-ignition in any of his patents. What he was aiming at was a process in which heat was utilized to the highest possible extent, and auto-ignition became embodied in the process incidentally during the evolution of the design. "The height of compression," said Dr. Diesel, "was not determined by the ignition limits of the fuel, but solely by the endeavor to obtain the highest possible figure for economical fuel utilization."

Electricity

Wireless Telegraph Station at the Vatican.—It is stated that a private wireless telegraph post is to be installed in the Vatican which will transmit to a considerable distance, and the Marconi wireless company has already furnished the first part of the apparatus. The antenna will be set up in the gardens of the Vatican.

Rathenau Medal Awarded to Edison.—On the evening of January 23rd at the American Museum of Safety, the Rathenau medal for the best electrical process or device for safeguarding life and health will be awarded to Thomas A. Edison. He will be the first American to obtain the prize. It will be presented to him because of his storage battery, which provides a safe power supply for use in mines, submarine boats, and factories where explosives are made.

Increase in the Use of Wireless Telegraphy.—The annual report of the British Postmaster-General states that wireless telegraph messages sent to and from ships have increased 11.8 per cent beyond the previous year. The increase is partly due to the larger number of vessels now equipped with "wireless" and partly to a reduction of tariff for vessels making short voyages. Nearly all of the wireless stations in Great Britain are now in the hands of the Post Office, the only private commercial stations being the Marconi stations at Clifden and Poldhu.

Twenty-seven Years' Progress in Incandescent Lighting.—An English electrical magazine publishes an interesting diagram showing the progressive reductions in the cost of the incandescent electric light which have taken place since 1885. The improvement has been twofold: in the increasing efficiency and life of the lamp, and in the reduction in the cost of current. It is probably not realized by the average consumer of electricity that whereas the first carbon filament lamps, supplied with energy at about 25 cents per unit and consuming 5 watts per (British) candle-power, gave only 200 candle-hours for 25 cents, with the best type of drawn-wire tungsten filament lamp to-day, supplied with energy at 8 cents per unit and consuming 1¼ watts per candle-power, the same sum of money gives 2,400 candle-hours.

Replacing Reciprocating Engine-driven Generators by Turbine Units in England.—In one of the generating stations of London it is proposed to "scrap" engines and generators only ten years old, and of 14,000 kilowatts aggregate capacity, because the present output of the station is insufficient to meet the demands of the tramways supplied from this station. By replacing four reciprocating engine units of 3,500 kilowatts capacity each by four 8,000-kilowatt steam turbine-generators, the maximum output will be largely increased. Two of the old sets will be changed at a time, and it is estimated that the saving in coal will be over $57,000 for the first two turbines, which more than offsets the debt charges incurred by the change.

A New Direct-current Steam Turbine-generator.—The generation of direct-current electrical energy by the steam turbine-generator has been a problem on account of commutator difficulties at the high rotating speed at which the steam turbine should run in order to show a steam economy comparing favorably with the reciprocating engine. In the effort to solve this problem so-called "unipolar" steam turbine-generators having a highly simplified current-collecting device, and reduction gearing between the steam turbine shaft and the electric generator shaft, have been tried. A new scheme for direct-current generation is now announced in the form of an alternating-current induction generator combined in one machine with a rotary converter. In this "turbine converter" one member of the generator is mounted on the converter shaft and the other member (usually a squirrel-cage rotor) on the turbine shaft with the revolving field of the generator arranged to rotate the same way as the converter armature, giving a net generator speed equal to only a fraction of the turbine speed. In a set of 500 to 600 kilowatts capacity the full-load efficiency is stated to be 94 per cent.

Magnifying Feeble Signaling Currents.—Two interesting types of relay for submarine cable work, designed to improve on the "siphon recorder" invented by Lord Kelvin in 1867, were described at a recent exhibition of electrical apparatus in London. The problem of high speed working is to cause very feeble transient currents to make distinct records. In one of the new devices the object is attained by mechanical means. The suspended coil of the relay has two silk fibers running to and around a rotating spindle. The slight movement of the coil in either direction, by slightly increasing the friction of one or the other of the fibers on the rotating spindle, causes the latter to supply a supplementary force many times greater than that exerted by the coil itself. The other device virtually magnifies the feeble arriving current by thermo-electric means. The suspended coil carries an arm at the end of which are two tiny thermo-electric couples forming a T between two little alcohol flames. The slight movement of the coil, by turning one or the other of the thermo couples toward one flame and away from the other, generates a current in the one direction or the other 27 times greater than the received current.

Science

A Swiss National Park.—A magnificent national park, the largest in Europe, is about to be established in the canton of Grisons, Switzerland. It will ultimately have an area of nearly 80 square miles, all of which will be wholly withdrawn from human interference and set aside as a biological preserve.

Changes in the Map of Greenland.—A series of maps presenting the results of the surveys carried out by the ill-starred Mylius Erichsen expedition of 1906–08 to northeastern Greenland has been published in the *Geografisk Tidskrift*. These show that Greenland extends much farther east than was formerly supposed, and add about 150,000 square miles to its area.

Amundsen's Proposed North Polar Journey has been postponed for a year, at the suggestion of the Norwegian government, seconded by Prof. Nansen, in order to give the staff more time for thorough training in oceanography, the subject to which the expedition will devote principal attention. Captain Amundsen is to be presented with a gold medal for his discovery of the South Pole, at the annual banquet of the National Geographic Society, in Washington, January 11th.

A Princely Bequest to Science.—The will of Albert Samson, who died recently in Brussels, bequeathed the bulk of a large estate for scientific researches. Two endowments are created, one under the control of the Royal Prussian Academy of Sciences, the other to the Royal Academy of Sciences at Munich. The Prussian endowment is worth $500,000, the Bavarian $100,000. The Berlin endowment is to carry out scientific researches into individual as well as social ethics. The endowment for the Munich Academy has a similar purpose.

French Expedition to Morocco.—The Geographical Society of Paris, aided by the French Adademy of Sciences, the National Museum of Natural History, and a number of banking institutions, has organized an expedition which will carry on elaborate scientific explorations in Morocco for four or five years, and perhaps longer. The party is made up of well-known specialists in several fields, including M. Gentil, who will have charge of geology and mineralogy; M. Bauguil, in charge of agronomy; M. Pallary, zoology; and Prof. Pitard, botany.

An Institute to Study Fuels.—Under the auspices of the Kaiser Wilhelm Scientific Society there has been founded an institute for research upon combustibles. The buildings of the institution are to cost $150,000, and the State allows an annual endowment of $30,000. Another endowment coming from the mining syndicate of Westphalia and the Rhine amounts to $25,000, and the above-mentioned society itself contributed the sum of $5,000. It is stated that the buildings of the institution will be opened for use early in 1914, and the director is to be Prof. F. Fischer, of the Berlin Hochschule.

Changes in the Weather Bureau.—The River and Flood Division of the Weather Bureau, which has charge of the important work of stream-gaging and river-stage prediction, has been placed under the direction of Prof. A. J. Henry, lately in charge of the Mount Weather Observatory. He is succeeded at the latter institution by Dr. W. R. Blair. Three officials of the Bureau have recently been promoted to the grade of professor of meteorology, viz., Dr. O. L. Fassig, the well-known climatologist, now in charge of the station at Baltimore; J. Warren Smith, a specialist in agricultural meteorology, who is stationed at Columbus, O.; and W. M. Wilson, stationed at Ithaca, N. Y. C. Fitzhugh Talman, librarian and supervising examiner of the Bureau, and W. R. Blair, of the Mount Weather Observatory, have been appointed junior professors, a new grade in the service.

The Sphygmomanometer is an instrument of recent invention for measuring the blood pressure. The name is derived from *sphygmos*, the pulse; *manos*, thin, rare; and *meter*, a measure. The manometer had been in use for some time as an instrument for measuring the tension of gases and vapors, and was readily adapted to testing blood pressure by adding a rubber bulb and a cuff with rubber bag attached on the inside. This is placed over the brachial artery, above the elbow, and when the pressure through the rubber bulb has shut off the artery so the pulse cannot be felt at the wrist, the reading in the graded scale at the height of the column of mercury indicates the blood pressure. The normal blood pressure is 125 millimeters. In hardening of the arteries, and accompanying heart and kidney complications, the blood pressure is an important symptom to be studied. Several of the large life insurance companies require the blood pressure to be taken in applications for large amounts. One company requires it in all applicants without regard to age or amount. This company claims to have saved $50,000 in losses the first year in which they required the use of the sphygmomanometer. They followed the history of cases rejected on account of high blood pressure only, and found several who died within the year of apoplexy.

Moving and Talking Pictures

MOTION pictures are at the present time usually exhibited by optical projection, enlarged images of pictures carried by a long strip of film being thrown upon a screen or curtain. This process is to a large extent the reverse of that employed in taking the pictures, to effect which reduced images of the scene which is to be reproduced are allowed to fall in succession upon a sensitized film. In the apparatus commonly employed for obtaining the pictures snap-shots are taken at the rate of sixteen per second upon the film, which is intermittently moved. A rotating shutter provided with an opening allows sixteen images per second to fall in succession upon the film. The apparatus is so constructed that the film is held stationary while each picture is taken and then is moved forward at a high rate of speed into proper position for the next picture, this movement occurring at the time when the shutter is so positioned as to protect the film from the light. The film carrying the exposures is developed, and from the negatives thus obtained prints are made upon a similar strip of film for use in the projection apparatus. This apparatus is usually similar to the camera except that a powerful light is provided to throw successive images of the pictures upon a screen. These images are enlarged by means of an objective lens, and appear upon the screen in such rapid succession that before one picture has time to fade from the retina of the eye another one is in view. Since each picture is slightly different from the preceding one, and since the pictures blend imperceptibly into each other, the illusion of movement is produced, and the observer sees the original scene re-enacted.

On August 24th, 1891, Thomas A. Edison filed two applications for patents, one of which became patent number 493,426, dated March 14th, 1893, and, therefore, expired on March 14th, 1910. The apparatus disclosed in this patent involves a cabinet having a sight opening across which the picture film is continuously moved, each picture being momentarily illuminated when it is accurately centered with relation to the sight opening. This device is not adapted to project pictures and provides for only one observer at a time. A device of this character was for a time in extensive use, but it has now been largely replaced by the projector. The other application referred to matured into patent number 589,168 on August 31st, 1897, and consequently does not, or rather the reissues which have superseded it do not expire until August 31st, 1914. The device covered by this patent is intended only for taking pictures, but is, however, illustrative to a large extent of the principle both of the camera and the projector commonly used. The apparatus is shown in Figs. 1 and 2. The film 3 passes the lens tube on its way from the reel 1 to the reel 2, being drawn along by two feed wheels 5, the teeth of which engage perforations placed along each side of the film. The film would move continuously were it not that the rotation of the feed wheels is periodically checked by the interaction of two toothed wheels, the one 25 mounted on the main shaft 26 and the other 23 on the feed wheel shaft 6. One tooth of the wheel 23 is allowed to escape at a time, and thus the film is intermittently advanced. Mounted on the shaft 26 to rotate between the film and the lens tube is a disk 31, which is apertured to permit the light rays to fall upon the film each time the latter stops.

Although present machines differ from this machine, yet certain features have been used in various machines. This patent has, therefore, been made the basis for litigation. The Court of Appeals of the Second Circuit (114 F. R., 926) held claims 1, 2, 3 and 5 of this patent invalid on account of being broader than the state of the art warranted. Claim 1 covered the combination of three elements: (1) any means capable of intermittently projecting at such rapid rate as to result in persistence of vision, images of successive positions of the object or objects in motion as observed from a fixed and single point of view; (2) a sensitized tape-like film; (3) any means for so moving the film as to cause the successive images to be received thereon separately and in single line sequence. The scope of the second claim was the same except that it was limited to a single camera with a single lens. The third claim differed from the second only in that it was restricted to intermittent motion of the film and exposure of the film during the periods of rest. The court based their decision on the following four references: The French patent to Ducos of 1864 describes a camera having a large number of lenses caused to act in rapid succession upon a series of sensitized plates or a surface of sensitized paper. The lenses and the sensitized surface move continuously at the same rate of speed while the picture is taken, one lens after another passing an aperture which admits light. The images are formed from the same point of view—the single aperture. U. S. patent to Le Prince, 376,247, January 10th, 1888, discloses a camera provided with a battery of sixteen lenses which act upon two strips of sensitized film placed side by side. The lenses are provided with shutters, eight of which facing one film are operated in rapid succession. The eight facing the other film are then operated, during which time the first film is moved into position to receive another eight exposures and so on. Unlike the Ducos camera, the lenses in this device are fixed and, therefore, the pictures are not all taken from the same point of view. The photographic gun of M. Marey, described in the SCIENTIFIC AMERICAN SUPPLEMENT of June 10th, 1882, discloses a single lens camera which takes twelve pictures in a circular series around a sensitized plate rotated behind a slit which allows entrance of light. The plate is rotated intermittently by clock-work arranged to give one rotation with twelve periods of rest. The number of exposures for one operation is limited to twelve. Mr. Levinson in the *Brooklyn Eagle* of June 14th, 1888, described a camera for taking motion pictures in which a single lens is employed to obtain images on plates carried by an intermittently operated wheel, each plate being exposed while at rest. He stated further that the mechanism employed to drive the plate carried could be employed to operate a continuous strip of paper or a film carrier. The court held that in view of these references the invention of Mr. Edison was not in such sense a primary one as to authorize the claims on which suit was brought. In regard to the prior art they stated in particular that he was anticipated by Marey in an apparatus capable of producing negatives and embodying means for passing a sensitized surface across a single lens camera at a high rate of speed and with intermittent motion and for exposing successive portions of the surface during periods of rest. The fifth claim of the patent, which was for a film having the photographs thereon, was also held invalid in view of the references. Claim four of the patent was not included in the suit and was not passed upon by the court in this decision.

After the patent had been adversely passed upon, it was reissued in two parts: Reissue No. 12,037 for the camera and reissue No. 12,038 for the film. The reissue for the camera contained four claims, the first three being more limited than those in the original, while claim 4 was the same as claim 4 of the original. Claim 1 contained four elements: (1) a single stationary lens; (2) a single sensitized tape-film supported on opposite sides of and longitudinally movable with respect to the lens, and having an intermediate section crossing the lens; (3) feeding devices engaging such intermediate section of the film and moving the same across the lens of the camera at a high rate of speed and with an intermittent motion; (4) a shutter exposing successive portions of the film during the periods of rest. Claim 2 also included a continuously rotating driving shaft, by which the feeding devices and the shutter were operated. It limited the shutter to a continuously rotating shutter. Claim 3 differed from claim 2 in omitting reference to the shutter as being continuously rotating and operated by the shaft, and included a reel for winding

(Concluded on page 78.)

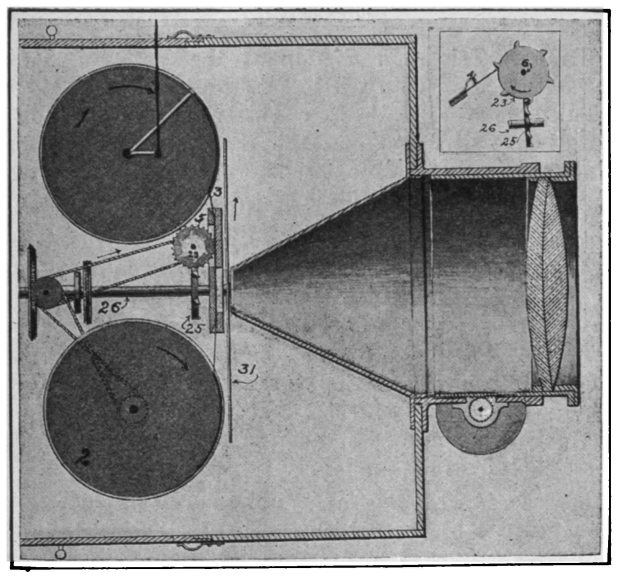


Fig. 1 and Fig. 2 (insert).—Edison projector.

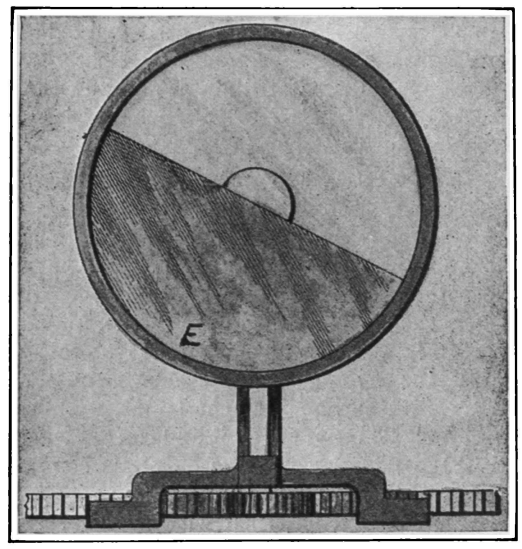


Fig. 3.—Segmental mirror of Gray's machine.

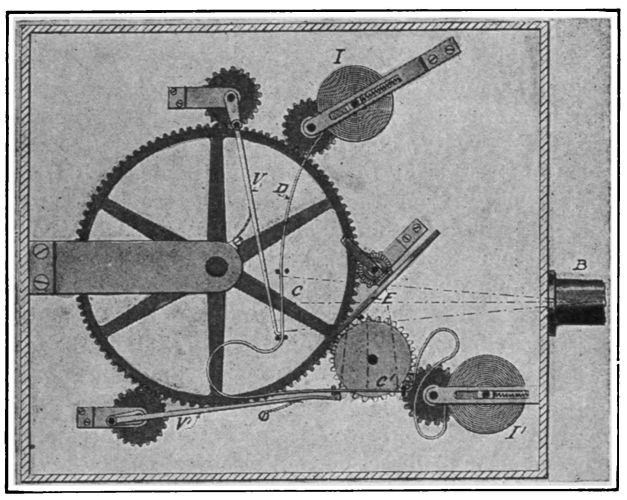


Fig. 4.—Gray's moving picture apparatus.

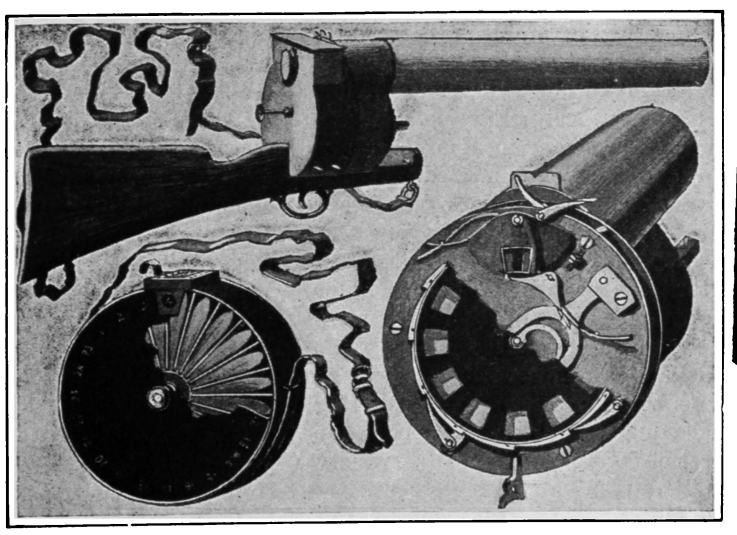


Fig. 5.—Marey's photographic gun.

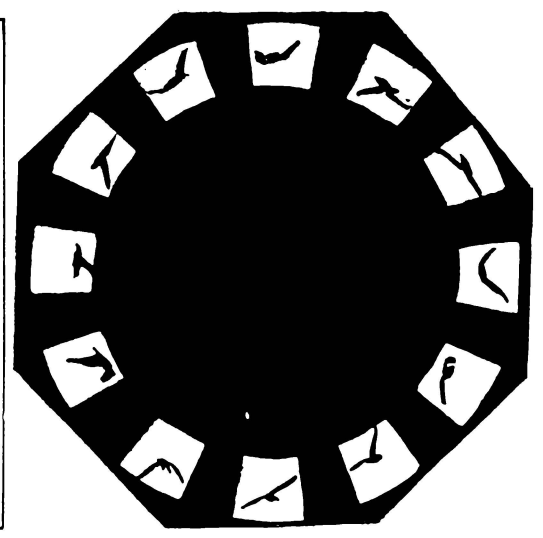


Fig. 5a.—Plate used in the Marey gun.

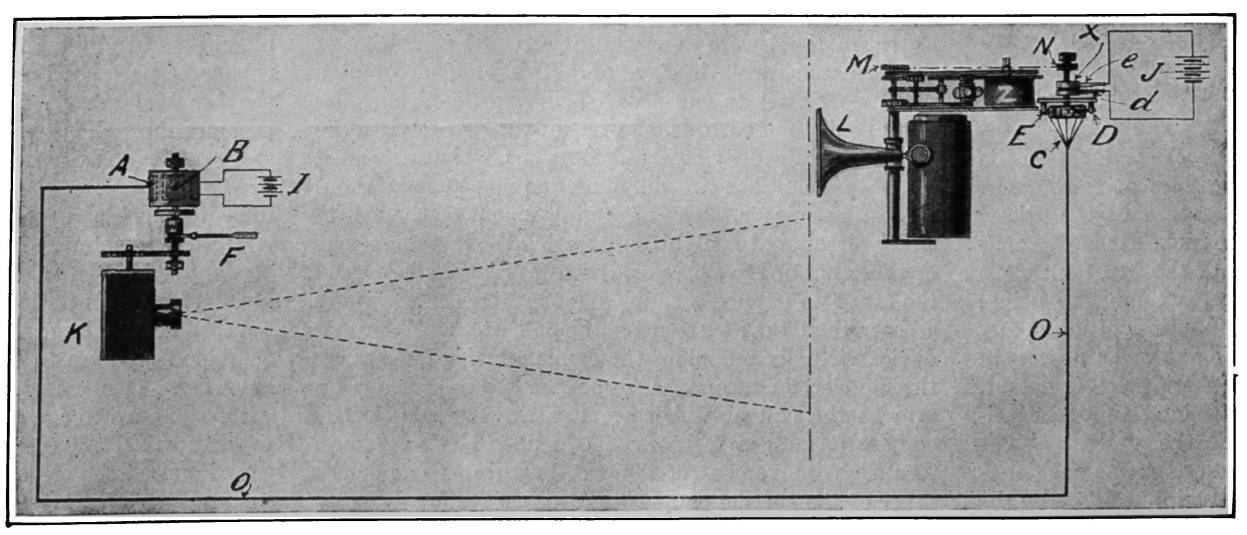


Fig. 6.—Gaumont moving and talking picture apparatus.

A Successful Automatic Train-stop

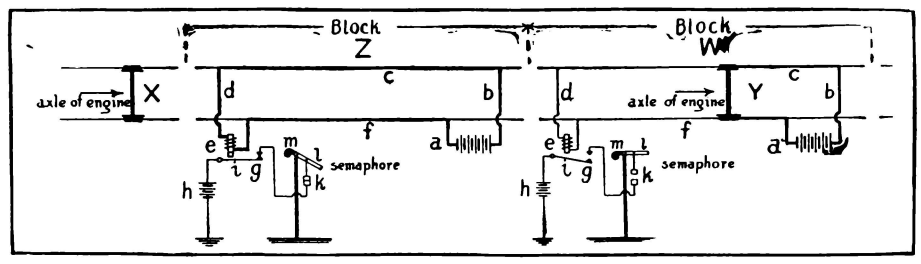
A Device Which Saves the Train, Reports Disregard of Signals, and Thereby Stiffens Discipline

IN the fourth annual report of the Block Signal and Train Control Board to the Interstate Commerce Commission in December, 1911, there occurs this paragraph: "The Board has no hesitancy in saying that, had the railroads directed the same efforts toward the development of automatic train-control apparatus that has been devoted to the development of interlocking and block-signalling apparatus, we should now have adequate installation of automatic train-control devices, which would permit an engineman to handle his train without interference as long as he did it properly, but would intervene to stop his train if he disregarded a stop signal or ran at excess speed, where speed restrictions were prescribed."

During the past fifteen years the SCIENTIFIC AMERICAN has repeatedly drawn attention to the growing number of fatalities and injuries on our railroads; and for many years we have urged the use of the automatic train stop as a salutary check upon disobedience of signals and a most effective safeguard of the lives of passengers. Unfortunately, the railroad companies, for various reasons, have been opposed to the train stop, and with a few exceptions it is only recently that they have begun to give it unwilling attention. A few roads, operating under special conditions, have installed the stop, and in such cases, particularly on the New York subway, it has proved to be a brilliant success. To-day, some roads are testing out devices of this kind that have been developed on the outside; and one railroad has recently made the offer of a reward, the conditions of which will be found on the correspondence page of this issue, in which it solicits the assistance of the outside public in the solution of the problem.

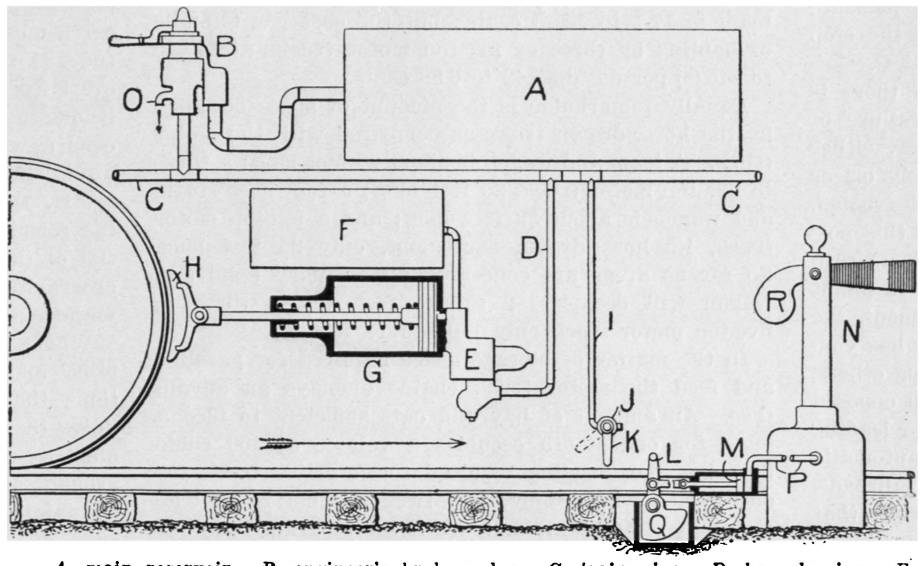
The success of the mechanical-trip train stop, as used on the New York subway, where, during several years of operation on express trains under a headway of one minute and 43 seconds, there has been only one failure out of 277,846 movements, proves that, when it is installed in subways or under conditions such as those on the Boston elevated road, where it is not subject to attack by snow and ice, this type of stop is thoroughly reliable.

For use in the open on steam railroads, however, where the mechanism both at the rail and on the train will be subject to destruction or disarrangement by snow and ice, or by trespassers on the tracks or intentional train wreckers, the problem is more difficult and modifications become necessary. In all probability it will be found that the most satisfactory system is one which operates electrically upon what is known as the "closed circuit" system, and dispenses altogether with projecting mechanical parts which are liable to be injured or entirely carried away in the stress of day-by-day railroad operation. Also, it may be taken for granted that the successful, electrically-operated device must form part of or co-act with the track circuits which operate the standard block signals as installed on our railroads.



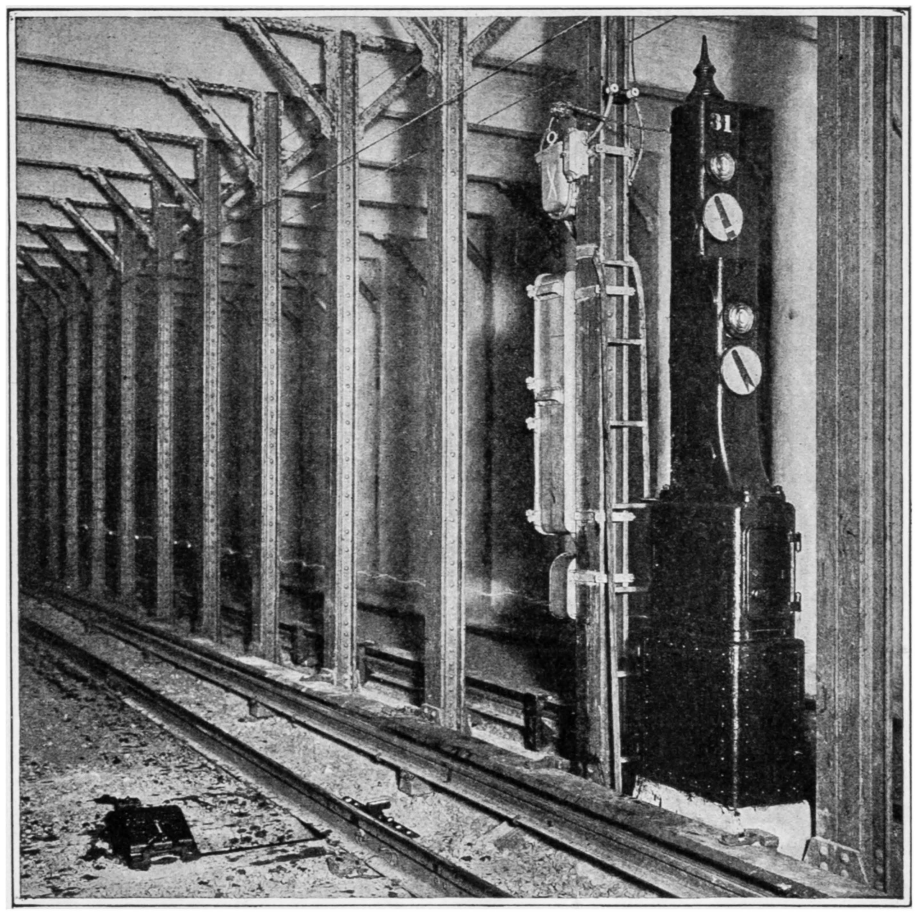
In block *Z*, which is clear, track battery *a*, through circuit *b*, *c*, *d*, *f*, relay *e*, contact *g*, and signal battery *h*, causes magnet *k* to lower semaphore *l*. In block *W*, engine axle *Y* short-circuits track-current, *l* is released and raised by counterweight *m* to stop position.

Diagram of standard block signal system.

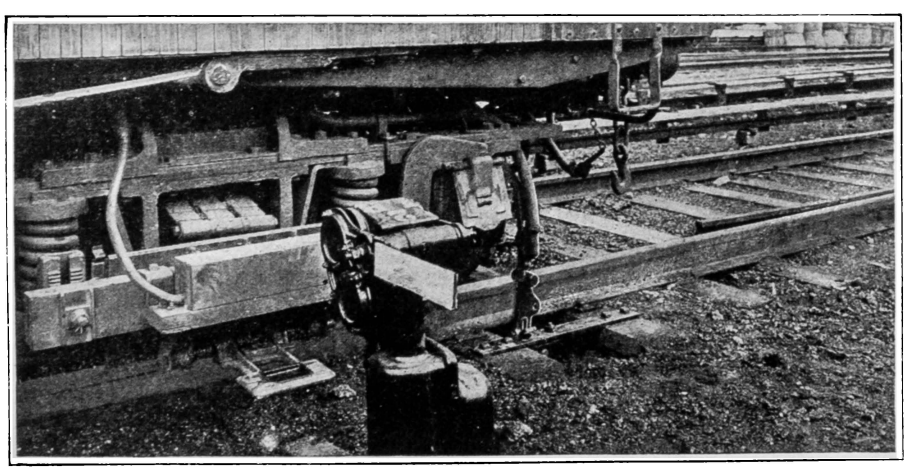


A, main reservoir. *B*, engineer's brake valve. *C*, train pipe. *D*, branch pipe. *E*, triple valve. *F*, auxiliary reservoir. *G*, brake cylinder. *H*, brake shoe. *I*, trip branch pipe. *J*, trip valve. *K*, trip valve lever. *L*, trip. *M*, trip piston. *N*, signal. *O*, exhaust from train pipe. *P*, air pipes. *Q*, stop counterweight. *R*, signal counterweight.

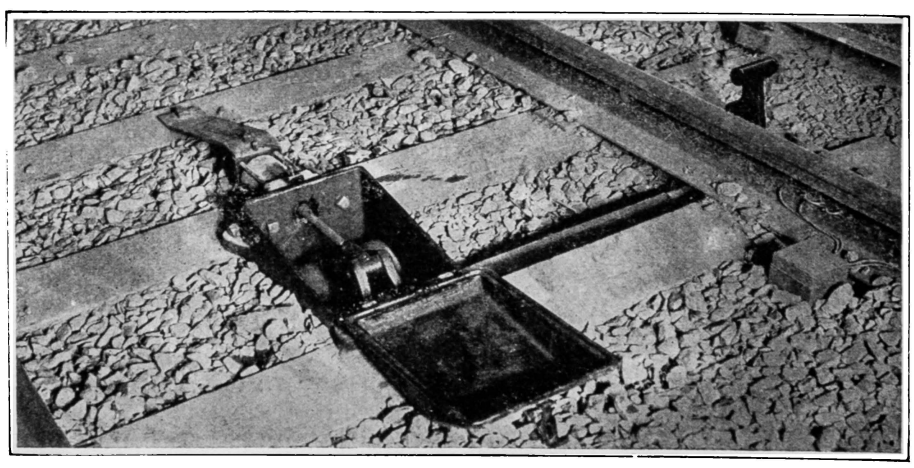
Relation of automatic signal and stop to train brakes.



Home and distant signals clear, stop lowered.



Stop raised opens valve on pipe and sets brakes.



Counterweight in box raises stop when signal is at danger.

AUTOMATIC SIGNALS AND STOP AS USED IN NEW YORK SUBWAY.

In block *Z*, which is clear, track battery *a*, through circuit *b*, *c*, *d*, *f*, relay *e*, contact *g*, and signal battery *h*, causes magnet *k* to lower semaphore *l*. In block *W*, engine axle *Y* short-circuits track-current, *l* is released and raised by counterweight *m* to stop position.

It is necessary that anyone who undertakes to solve this problem should have a clear understanding of the operation of the electrically-controlled, automatic block signal system. To this end we have prepared the accompanying diagramatic view showing its basic features, which consists of a track battery *a*, furnishing a low-voltage electric current through wire *b*, to one line of track rails *c* at the end of a block *Z*, which is isolated by means of insulated joints from the adjoining blocks, a wire connection *d* to a relay *e*, which is energized by the current as thus supplied, and the other line of track rails *f* closing the return circuit to track battery *a*. The relay being thus energized, attracts the armature *i* and makes the contact *g*. This permits current to flow from a signal battery or other source of power *h* to the signal magnet or motor *k*, which holds down the semaphore *I* against the action of the counterbalance *m*, which normally holds the semaphore in the horizontal or stop position. A train *X* approaching block *Z*, observes that the semaphore is in the downwardly inclined position, and has the right to proceed into the block *Z*.

If a train *Y* occupies block *W*, the front axle of the train short-circuits the track current, the relay is de-energized, and it no longer holds the armature against the contact. Thereupon the signal magnet or motor, as the case may be, is deprived of current and the counterbalance weight *m* automatically draws the semaphore into the horizontal or stop position, warning the approaching train that the block is occupied. A broken rail interrupting the flow of current in the track circuit, or any defect in the apparatus that breaks the circuit, de-energized the signal magnet or motor *k* and allows the semaphore to go to the stop position.

This method of controlling the signals is known as the "closed circuit" principle. It is essential to the safe operation of a system which must err on the side of safety should anything go wrong. Every successful automatic stop must be arranged on this same closed-circuit principle; it must be included in the circuits which control the block signals; its movements to clear or stop must be co-incident with those of the signals, and any failure of the circuits or mechanism must cause it to be drawn by gravity to the stop or danger position.

Now the same broad principle is followed in the automatic airbrake (see diagram). The main reservoir *A* on the engine, the train pipe *C*, which runs the full length of the train, the auxiliary air reservoirs *F* on each car, are normally maintained under full air pressure. When the engineer opens the brake valve *B* the pressure in the train pipe *C* and branch

pipe *D* is reduced, and this causes the triple valve *E* to admit air from the reservoir *F* to the brake cylinder *G* on each car, thereby setting the brakes. Any failure of the air pressure, as in case of a train breaking in two, causes the brakes to be automatically set. For automatic stop setting of the brakes, a trip branch pipe *I* is led down from the train pipe and terminates in a trip valve *J* provided with a trip lever *K*, which is so placed that it will engage with a trip *L*, when the latter is in the raised or stop position.

The mechanical trip as installed in the New York subway and elsewhere is shown in the diagram and in the three photographic views. It consists of a short lever placed adjacent to the track rail, which is normally held down clear of the trip valve lever *K* by the compressed air piston *M*. The valves admitting compressed air to the back of this piston and to the piston operating the signal *N* are controlled by electro-magnets in the signal circuit, as described above. Normally, the trip, like the signal, is maintained in the clear position: but when the block is occupied, the air pressure back of *M* is released and the trip rises to the stop position under the action of the counterweight *Q*.

Now it is evident that the weak point, if there is one, in this system is the possibility of a failure of the trip to register with the trip valve lever, either through one or the other being broken entirely off or twisted, or through their movements being obstructed. In the New York subway or on the elevated, this possibility is very remote; but in the open on steam railroads, especially during the winter months, it might well happen. If there were such disarrangement, the engineman would be unaware of it. Herein lies considerable peril; and it is for this reason, among others, that railroads operating in the open have been opposed to the mechanical stop. To quote one of the leading railroad engineers in the country: "If an automatic stop is to be generally employed on American railroads, it must be certain in its action, and this means that it must be constructed on the closed-circuit principle, a failure in the co-ordination in the parts of which must be just as certain to stop the train as a fractured rail or a defect in the apparatus will bring about a stop indication of the signal semaphore."

In the presence of this dilemma, the thoughts of inventors have naturally turned to electricity and the substitution of electrical contacts for mechanical stops. One system, the Lacroix, using a third-rail contact and a closed electrical circuit in the cab, after undergoing a series of tests by the Block Signal and Train Control Board, received the following endorsement: "The test indicated that the apparatus could be expected to operate satisfactorily under severe weather conditions. . . . The system with reasonable inspection and maintenance would be safe, reliable, and its use would tend materially to promote safety of operation on a railroad using it." We quote this case to show how entirely without justification is the contention of the steam railroads that there is no automatic stop in existence or in sight, that will meet the severe requirements of daily out of doors operation.

Admitting as essential to a successful stop the principle that the whole apparatus—track circuit, engine circuit and the contact relations between the two—must be upon the closed-circuit principle, detecting its own failures and incapable of giving a false "clear signal," this problem becomes a most interesting and attractive one, capable of a wide range of variation in its solution. The automatic train stop has come to stay. Its necessity is becoming increasingly realized, and it is to be hoped that the railroads generally will change from an obstructive to a favorable attitude, and that the train stop will be adopted voluntarily and widely and without any resort to Federal legislation.

The Death of Dr. Lewis Swift

ON January 5th Dr. Lewis Swift, one of the great astronomical observers of our time, died at Marathon, N. Y., at the ripe age of ninety-two. He was chiefly noted for his work on nebulæ, of which he discovered 1,240, his studies of comets of which he discovered 14, his investigations of shooting stars, solar eclipses and possible intramecurial planets. It is said that his first interest in astronomy was aroused by reading Dr. Dick's books at a time when he was in business. He made his reputation with the discovery in 1862 of the great comet that bears his name, a discovery that resulted in his removal from Hunt's Corners to Rochester. There, on the roof of a cider mill he set up an humble observatory where he discovered comet after comet and nebula after nebula. Much of this work was done while he was in business in Rochester.

Blackening Tan Leather

TO blacken tan leather it should be first rubbed with a ten per cent solution of tannic acid. Let this solution dry thoroughly, when a ten per cent solution of iron sulphate should be applied. This gives an intense black, is easily applied and is harmless to the operator.

Teams and Motor Trucks Compared

By H. W. Perry

THE front page illustration tells its own story so plainly that it is almost unnecessary to amplify it. Some of the advantages of the motor truck over the team drawn wagon may be thus summarized:

The average distance covered per day by a two-horse team varies between 16 and 20 miles, whereas the average distance covered per day by a three or five-ton motor truck varies between 40 and 60 miles. Horses and wagons could serve daily an area of 314 square miles on a ten-mile radius; on the other hand motor trucks, operating on a 25-mile radius, would cover 1,963 square miles.

The work done by a two-horse team per day varies from 48 to 60 ton-miles. On the other hand, motor trucks of from three to five-ton capacity perform an amount of work measured by 165 to 225 ton-miles per day.

At $8.50 per day, the cost per ton-mile of hauling by team is 17.7 to 14.16 cents; but the cost per ton-mile of hauling by three or five-ton motor trucks at $12.25 to $15.60 per day is 7.42 to 6.88 cents.

Equally remarkable is the amount of space occupied by the horse-drawn truck as compared with the motor truck. A team and wagon is about 26 feet long; a three to five-ton motor truck, 20 feet long; a four-horse team and wagon is about 39 feet long; and a ten-ton motor truck, its horse-drawn equivalent, only 25 feet long. So far as areas are concerned an ordinary team and wagon will occupy 182 square feet, but a three to five-ton motor truck only 140 square feet.

In the matter of storage space required for gasoline and feed the motor truck engine displays an advantage. An amount of hay and oats sufficient to feed a team for one month occupies a volume of 100 cubic feet, but the gasoline required for a motor truck for one month will occupy only twenty cubic feet. The cost of hauling by motor truck is incomparably cheaper than by horse and wagon. Thus, the cost of hauling 1,000 tons ten miles by horse and wagon is $160, but only $70 by motor truck.

The amount of work performed by one motor wagon is equivalent to the amount of work performed by three and one half average teams. To haul 585,000 tons an average distance of one mile in a year, would require 100 teams; but 39 motor trucks would theoretically be required to haul the same load an average distance of one mile in a year.

The cost of keeping and using 39 teams and wagons per year would be $99,450; but the cost of keeping and using ten motor trucks would be only $42,000.

Judging by the registration of horse-drawn wagons in Chicago, the use of horse-vehicles is decreasing at the rate of 15.3 per cent per annum. In other words 68,000 horse-drawn wagons were registered in Chicago in May, 1911, and only 53,600 in September, 1912. On the other hand the use of motor trucks is increasing at the rate of 120 per cent a year, this estimate being also based on Chicago statistics. It seems that the number of motor wagons registered in Chicago in May, 1911, was 800, and the number in September, 1912, 2,094.

Brontidi

IN this week's SCIENTIFIC AMERICAN SUPPLEMENT Mr. C. Fitzhugh Talman gives an account of some curious acoustic phenomena which have been generally called "brontidi," "mistpoeffers," or "Barisal guns," but which bear scores of other names in various parts of the world. They take the form of muffled detonations, resembling the sound of distant cannon or peals of thunder, and are heard chiefly in warm, clear weather.

The first systematic investigations of these phenomena were made in India. The fact that they were frequently reported from the neighborhood of Barisal, a town in the Ganges delta, led to their being called "Barisal guns;" under which name they were first made known to European science at the meeting of the British Association in 1890. A few years later they were discussed in an extensive memoir by E. van den Broeck, who had collected numerous reports of their occurrence in Belgium, where they are known as "mistpoeffers" (i. e., "fog-belchings" or "fog-hiccups"). The most extensive literature on the subject, however, has come in recent years from Italy, where the sounds appear to be extremely common, though very local in their distributions; they are well known in some localities, but entirely unknown in others not far distant. They are popularly known under a great variety of names in Italy, but since 1904 have been generally called by Italian scientific writers "brontidi"—a conveniently non-committal term formed by Prof. Tito Alippi from two Greek words meaning "like thunder." (This is likely to become the international name, with or without changes in termination to suit the various languages, i. e., "brontides" in English and French). In Australia the noises are called "desert sounds," in Haiti, "gouffre," etc. They have been reported from some parts of the United States, especially California. It is difficult to define their distribution, because, except in places remote from human habitation, they are likely to pass unobserved—being taken by most people for actual discharges of cannon, blastings, explosions, and the like.

When once the attention of the world had been directed to the widespread occurrence of brontidi it was found that there are rather numerous references in early literature to apparently the same phenomena. Thus Lord Bacon speaks of "an extraordinary noise in the sky when there is no thunder."

The latest views as to the origin of brontidi are summed up as follows:

"Many suggested explanations that seemed more or less plausible when the problem was viewed as a local one—as in the early discussion of Barisal guns—are invalidated by the wide range of physical conditions under which the phenomenon is now known to occur. The trend of recent opinion is toward looking upon the source of brontidi as subterranean in most cases, though perhaps not in all. Movements within the crust of the earth must frequently set up vibrations of such amplitude as to affect the ear, when communicated to the overlying atmosphere. Assuming the focus to be far below the surface, the air would be set in vibration over a wide area, giving the indefiniteness as to the direction of the sound that is commonly noted. Prof. W. H. Hobbs, who has made a painstaking study of the seismic geology of Italy, concludes that the brontidi of that country are due to the slow settlement of orographic blocks, and the consequent production of vibrations within their marginal zones."

Whatever the initial cause of the sound, its audibility appears to depend upon definite acoustic conditions that require further investigation. Alippi believes that in order that the sounds may be heard they must be re-inforced by a peculiar configuration of the ground, above or below the surface, and he attaches special importance to the effect of caverns, which he suggests act as resonance boxes in the production of audible brontidi.

A New Industrial Process for Manufacturing Oxygen

By Our Berlin Correspondent

DR. G. KASSNER, professor at Münster University, has designed a new process for the manufacture of oxygen which is based on the Tessié du Motays process but, thanks to the absence of any antagonistic effects, lends itself to a far better industrial application than any chemical method so far suggested. Kassner adds to the alkali manganates used in the Tessié du Motays process an alkali salt of metaplumbic acid, thus increasing enormously the efficiency and constance of the mass. The process comprises two phases characterized by the action of currents of steam and air, respectively. During the first phase the alkali given off by dissociation is immediately absorbed by the alkali metaplumbate, thus forming orthoplumbate. Inversely, during the second phase, which is that of regeneration, the alkali absorbed by the metaplumbate is given back to the residual manganese oxide, thus forming alkali manganate. This is how the formation and decomposition of the manganate due to the addition of metaplumbate (which eliminates any disturbing antagonistic effects) takes place in continuous succession, without any appreciable alteration in the composition of the mass.

In opposition to physical processes which only utilize indirectly the heat units given off by the fuel, this chemical process works without any appreciable heat losses. It is carried out in the following manner:

After being introduced into a suitable apparatus refractory to heat and insuring a constant temperature, the active mass is, by means of a special fire-place, raised to and kept at the relatively low temperature of reaction of about 400 deg. Cent. A mechanically controlled valve causes separate currents of steam (exhaust steam, etc.) and air to enter this mass, at short intervals of equal duration. By inserting a very short discharging phase between the air and steam phases, any nitrogen left after regeneration in the pores of the mass is eliminated. The oxygen produced during the steam phase is led automatically into a gasometer set apart for this purpose. Moreover, a recovering apparatus serves to transmit any heat units escaping with the nitrogen, to the currents of air and steam entering the apparatus, thus preventing as far as possible any loss of heat. Finally, the process is so designed that the charge can be exchanged readily and easily, without any interruption in service worth speaking of, should it after some considerable time's working show any decline in its output which, however, will only happen exceptionally. As, in fact, the active mass remains constant in quality as well as quantity, it will at most require (after protracted working) a mechanical regeneration, restoring it to its previous porosity.

In view of the relative insensitiveness of the mass to the moisture of hot air, the new process would seem to lend itself for metallurgical applications.

The N. Y., N. H. and Hartford Railway's Automatic-stop Prize

Conditions That Must be Observed in the Competition for the $10,000 Award

THE New York, New Haven and Hartford Railroad Company has offered a reward of ten thousand ($10,000) dollars to whomsoever shall invent, perfect, and submit the best automatic device that will safely arrest trains disregarding fixed signals.

The reward will be paid on the order of the Interstate Commerce Commission, the Railroad Commissioners of Massachusetts, and the Public Utilities Commissioners of Connecticut.

Conditions of Competition.

1. Competitors must submit a typewritten or printed description of their device, describing in full all features wherein the device does or does not conform with the requirements as herein below set forth, in consecutive order.
2. Any device which in the judgment of the Signal Engineer of the New Haven Company does not satisfactorily meet the essential requirements, will be rejected, and if it is the desire of the competitor to have the device developed further, it will be done at his sole expense.
3. Any device appearing, in the judgment of the Signal Engineer, to have sufficient merit or promise to justify more extended consideration, the Railroad Company will assist Competitor by contributions of money or use of tracks, or both, in such measure as deemed reasonable.
4. Any device after meeting the requirements, must show an efficiency equal to that of the signal system in use on railroads at the present time, before same will be accepted.
5. Any device accepted will remain the property of the Competitor or Patentee, subject, however, to the reservation by the Railroad Company, of a right of use without further payments.
6. Before any device is accepted it must be adopted for general use by either the New York, New Haven & Hartford, the Pennsylvania, or the New York Central Railroads, within the year 1913, 1914, or 1915.
7. The device must also have the approval of the Interstate Commerce Commissioners, the Railroad Commissioners of Massachusetts, and the Public Utilities Commissioners of Connecticut.
8. Those desiring to enter this competition must file their application before July 1st, 1913.

Requirements of Stopping Device.

CHARACTERISTICS AS PUBLISHED BY THE TRAIN CONTROL BOARD OF THE INTERSTATE COMMERCE COMMISSION.

1. The apparatus should be so constructed that the removal or failure of any essential part would cause the display of a stop signal, and the application of the train brakes.
   If electric circuits are employed, they should be so designed that the occurrence of a break, cross, or ground, or a failure of the source of energy in any of the circuits, should cause the display of a stop signal, and the application of the train brakes.
2. The apparatus should be so designed that it may be used on the open railway, on bridges, on elevated structures, in tunnels or subways, and where either steam or electricity is used as a propelling power.
3. The apparatus should be so constructed as to conform to recognized standards of clearance of rolling equipment and structures, so that those portions of the apparatus placed on the roadway will not be subject to damage by rolling stock or engines, or those portions placed in the vehicle be damaged by structures permitted to exist on the roadway; and at the same time, all vehicle parts and roadway parts which may have to come into operative relation with each other, should be so designed that proper operative relation will be assured under all conditions of speed, weather, wear of tracks or vehicles, oscillation, and shock.
4. The system should operate under all weather conditions which permit the operation of trains.
5. The system should be capable of control by ordinary means used for indicating the condition of the block about to be entered, such as electric track circuit.
6. The engine apparatus should be so constructed as to prevent the release of the brakes after the application has been made until the train has been brought to a stop, or obstruction or other condition which caused the application has been removed.
7. The system should be so designed that should operating conditions require it, speed control may be used; that is, provision made for a train to pass an automatic stop in tripping position without the application of the brakes, provided the speed is less than a predetermined number of miles per hour.
8. The system should be so designed that when no cause for stopping a train exists, a definite and positive or proceed indication will be given at every point where a stop indication would be given or the brakes applied, when adverse or dangerous conditions exist.
9. The system should provide, at least for use under congested traffic, for the continuous display of indications, rather than for their intermittent display at certain definite points, as of course is necessary with fixed signals.
10. The apparatus should be so constructed and installed that it will not constitute a source of danger to trainmen or other employees, or passengers.

In addition to above, the following additional requirements must be met:

11. The apparatus should be non-inductive, so that its application to a railroad where alternating current electricity is used as a propelling power, it will not affect same.
12. The apparatus should be so constructed that it may be used with either absolute or permissive operation; also to cause trains to reduce speed at points where a reduction of speed is deemed advisable for safe operation of trains.
13. The apparatus should be so constructed that it will not be made inoperative by snow, ice, sleet or freezing conditions.
14. The apparatus should be so constructed that two or more engines may be used with one train, or a train may be allowed to assist another train without causing the brakes to be set on the second or following engine when passing a signal which indicated proceed when passed by head of train.
15. The apparatus should be so constructed that the automatic stopping device shall be operative only in the normal direction of traffic, except in connection with signals governing reverse movements.
16. The apparatus should be so constructed with speed control device, that a train may pass an automatic stop in stopping position without brakes being applied, provided the speed has been reduced to less than a predetermined number of miles per hour.
17. The apparatus should be so constructed that with speed control device applied, brakes can be released by engine or train crew after they have once been set by the stopping device, provided speed has been reduced to a predetermined number of miles per hour.
18. The apparatus should be so constructed, that if found desirable, proper apparatus can be provided on the engine to record the number of times the automatic stopping device has been applied to the brakes.

Rusting of Iron

IN some very interesting experiments by two German chemists, E. Liebreich and F. Spitzer, the cause of rust in cases which have seemed especially puzzling has been made very clear—as it was shown beyond question that the rust was caused by the paints themselves. They painted polished steel plates, and in order to distinguish them, numbered them with oil paint. The result was that the rusting took place just under the painted numbers—that is, where the "protective" coating was the thickest.

They went further in the matter, and examined iron business signs and the like. As a rule these were made of sheet iron, first painted with a ground color—mostly white; then the lettering was added, usually in black. Removing the coating, it was shown that the rust was most pronounced under the lettering; in fact in most cases was to be found only there.

This set the investigators to thinking; and they carried out their experiments with several kinds of paint, as follows:

White lead.
Zinc white (purest zinc oxide).
Red lead
Iron oxide.
White lead and lampblack.
Zinc white and lampblack.

Iron plates were brightly polished and four plates coated with the above paints, in different thicknesses of each, one plate getting but one coat, a second two, a third three, and a fourth four; time for drying being accorded. Then all the plates were subjected for a whole day to the action of the steam from water boiling in an open vessel (that is, under no pressure above that of the atmosphere).

The paint was then dissolved off to show the condition of the plates.

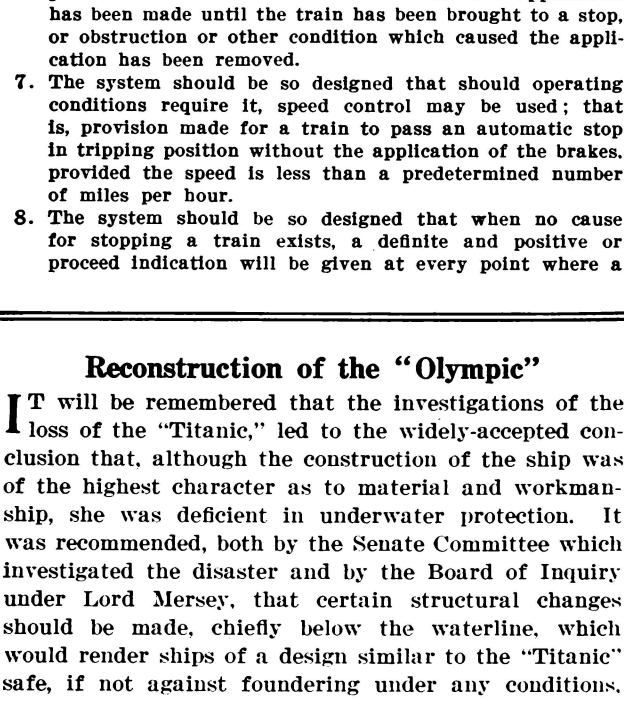
The result was surprising. Under all the single coatings the iron was not at all rusty; under the double coat, partly attacked; under the triple coat, more strongly; and under the four coats, thoroughly rusted!

Apparently one coat—at least of the above-named paints—is better than more. The explanation of this remarkable result would seem to be that the varnish in the second coat dissolves and loosens the first one, making it porous; and that the oftener this process is repeated, the more porous the paint becomes. It would also seem to indicate that one thick coat, if allowed to harden, would be better than several thin ones—which has not been considered to be the case. There seem to be no experiments in this particular on record.

Reconstruction of the "Olympic"

IT will be remembered that the investigations of the loss of the "Titanic," led to the widely-accepted conclusion that, although the construction of the ship was of the highest character as to material and workmanship, she was deficient in underwater protection. It was recommended, both by the Senate Committee which investigated the disaster and by the Board of Inquiry under Lord Mersey, that certain structural changes should be made, chiefly below the waterline, which would render ships of a design similar to the "Titanic" safe, if not against foundering under any conditions, at least against their foundering under a collision as serious as that which sank the great ship. The most important recommendation was that future ships should carry an inner skin, either in the form of plating on the inside of the main frames of the vessel, or in the form of longitudinal watertight bulkheads, built several feet inboard, which would form the inner walls of the bunkers and extend throughout the boiler spaces.

The owners have lost no time in following these suggestions on the sister ship "Olympic." During the past winter the "Olympic" has been withdrawn from service, and extensive reconstructions have been made at the Belfast yards. The principal change has been the carrying of the plating of the double bottom up the sides of the ship, as far as deck F. Below the lower deck, the inner skin, as thus riveted upon the frames, will be about 2 feet 6 inches distant from the outer skin of the ship. Between the lower deck and deck F, the skin will be about three feet inboard.



By courtesy of Dodd Mead & Co.

Sketch showing how the floor-plating of the "Olympic" was carried up the sides of the ship to form an inner skin.

Increasing the underwater protection of the "Olympic."

The importance of these changes will be readily appreciated and the nature of the construction understood, by reference to the accompanying sketch, which shows conditions in the ship as originally built, and as they will be when the inner plating has been completed. Formerly, a rupture of the outer skin admitted water entirely across the ship. In the future a rupture of this outer skin, unless the penetration were very deep, would admit the water only to the cellular space between the two skins.

Another improvement, which will add greatly to the safety of the ship, is that additional watertight bulkheads have been constructed fore and aft of the boiler spaces, some of which have been carried up to B deck, forty feet above the waterline. The White Star Company is to be congratulated upon the promptness with which it has recognized the lesson of the loss of the "Titanic" and taken steps to thoroughly insure her sister ship against any such disaster.

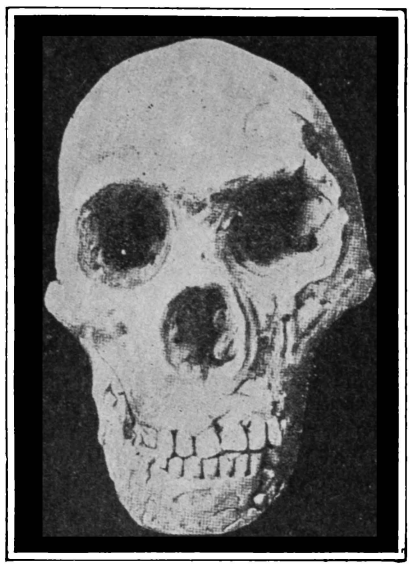
Artificial Sponges of Paper

WHEN paper pulp is treated with zinc chloride there results a viscous mass. Sodium chloride (or ordinary table salt) is added to this; the mass is then thoroughly rinsed with alcohol, and is finally submitted to the action of a press whose platform bristles with a number of fine metallic points or projections. These penetrate the mass, forming tubes like those in an ordinary marine sponge known as "*canaliculcs*."

The block thus obtained is of a spongy consistency and is both insoluble and unalterable in water. It is smooth and pleasant to the touch, and is not susceptible of putrefaction. It is a very ingenious employment of the cellulose to which we owe so much

Removing Iodine Stains

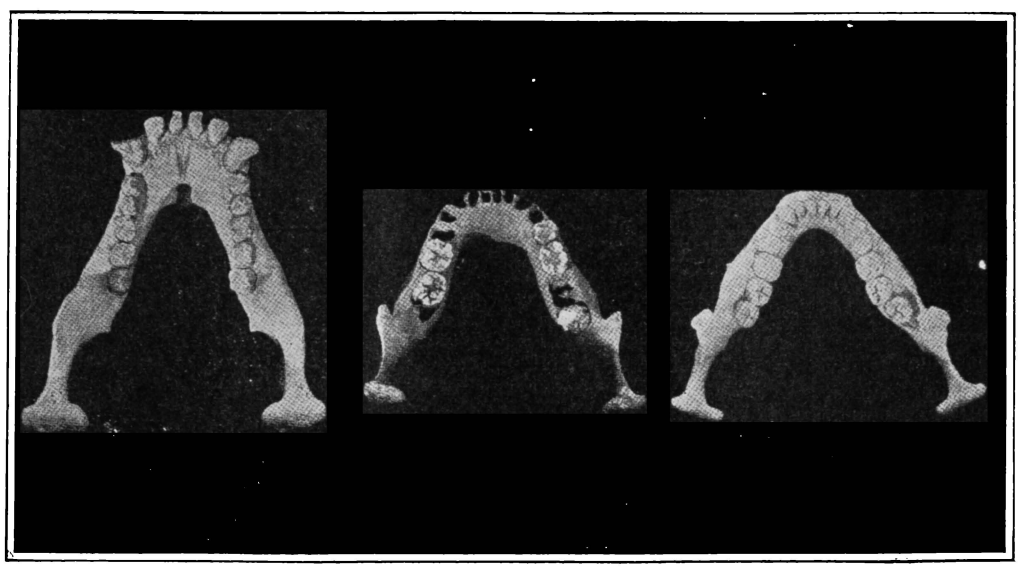
TO remove iodine stains from bacteriological instruments or the hands a strong solution of hypo sulphite of soda is good and effective. The solution should be quite strong, and after its application the solution should be rinsed off with warm water, and the stained article dried well.



By courtesy of *The Sphere*

Fig. 1.—Homo Mousteriensis.

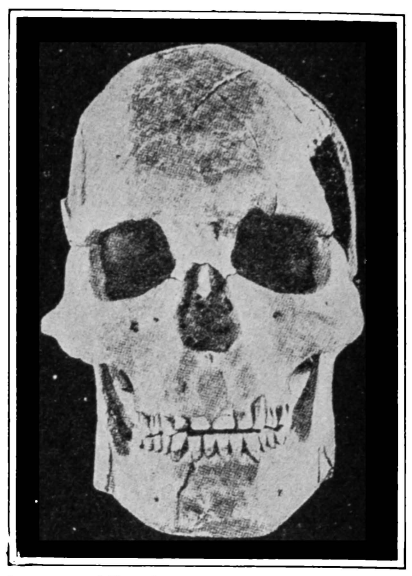
Very primitive type from the older glacial drift at Le Moustier, France.



By courtesy of *The Illustrated London News*

Fig. 2.—Jaws of chimpanzee, Australian native, and European.

Note the decreasing area of bony growth behind the front teeth, enlarging the mouth cavity for the development of speech. Also the absence of chin in the first two specimens.



By courtesy of *The Sphere*

Fig. 3.—Homo Aurignacensis.

From Aurignac, France. Probably dates from the middle of the glacial epoch.

New Evidence of the Origin of Man

The Earliest Known Inhabitant of Great Britain

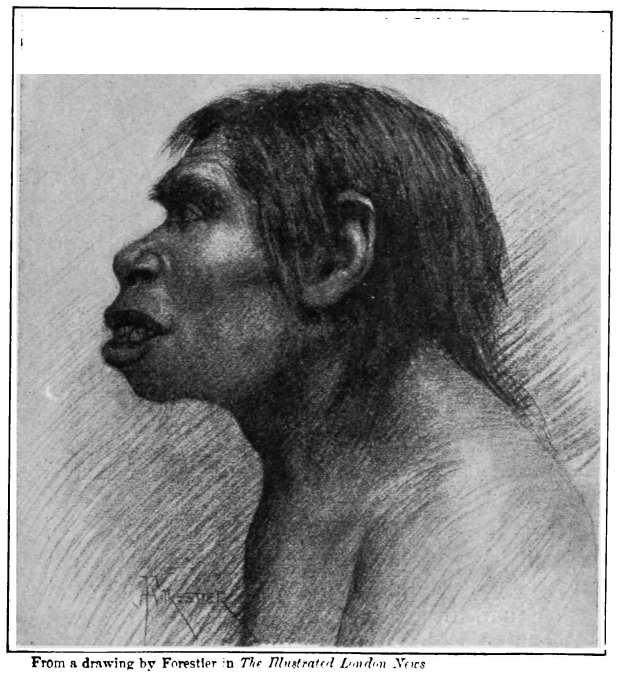
OF all the chapters of science perhaps none is so romantic as that which contains the fragmentary narrative of the dawn of human life upon our earth. The story is written with skull and cross-bone hieroglyphics, and no suspense that ever novelist contrived in his reader can equal that which the student of anthropology feels in the intervals between the successive "instalments" of the serial unearthed, here a page and there a page, now in the silt of a river in France, now on the banks of a German stream, or again, it may be, on British soil.

When, in the thirties of last century, Boucher de Perthes first claimed to have found flint implements shaped in glacial times by human hands, he was greeted with ridicule. Since then we have become quite accustomed to placing the origin of man at least as far back in time as the glacial epoch. But our knowledge of the early history of our race is based on all too scant data, and every new discovery of a jaw, a skull, or a more or less complete human skeleton, is received with intense interest. The latest addition to our knowledge of primitive man comes from Piltdown Common, Sussex, England. Here, in the gravels once forming the bed of the River Ouse, but now many feet above its present level, an English paleontologist, Mr. Dawson, discovered, about a year ago, a fairly complete human skull representing the most ancient relic of the human race in the British Isles, and one of the oldest found anywhere. The results of his studies of the specimen have recently been made public. Properly to appreciate the fine points of this find it is necessary briefly to recall some of the characteristic features presented to us on the one hand in the highest type of human skull, as represented in modern civilized man, and on the other by the various inferior types known to us in primitive man, living or extinct, and in our humbler relatives, the apes.

Considering first of all the jaw, we have several interesting points brought out in our illustrations, Figs. 2 and 5. The former shows side by side the jaws of a chimpanzee, a Torres Straits Islander, and a European. Note how in the European the chin is seen projecting beyond the teeth, as seen from above. The chimpanzee and the Torres Straits Islander have no visible chin. This absence of chin, imparting to the face a snout-like appearance, is typical of apes and low races of men, and is clearly indicated in our illustration of the newly found skull (Fig. 6), though unfortunately the part of the jaw carrying the incisor and canine teeth is broken off and missing. Another interesting feature should be noted: In the chimpanzees the bone at the front of the jaw is quite wide, leaving a comparatively small open space in the angle of the jaw. In the Australian native this space is larger, and in the European still more developed. When we remember the importance of the tongue in speech, this point acquires a marked significance.

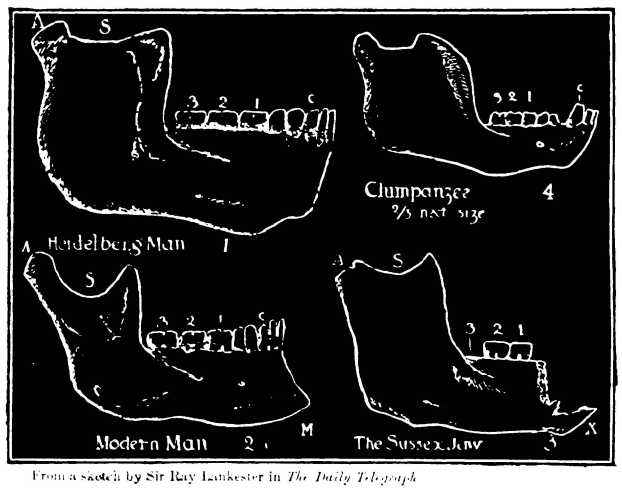
In profile view, as seen in Fig. 5, several points of interest also appear. The jaw of the ape and lower types of man is much more massive, and the notch in the upper end of the jaw—the sigmoid notch as it is called—is quite shallow in the ape, only slightly deeper in primitive, but is strongly developed in modern man.

As regards the brain case, the feature to which we naturally turn our attention first is capacity or cubical content. In this respect the newly discovered skull does not seem to stand as low in the scale as some specimens previously discovered elsewhere. A graphic comparison of the Sussex skull and the modern type is shown in Fig. 6. In this connection it is interesting to quote from Darwin:



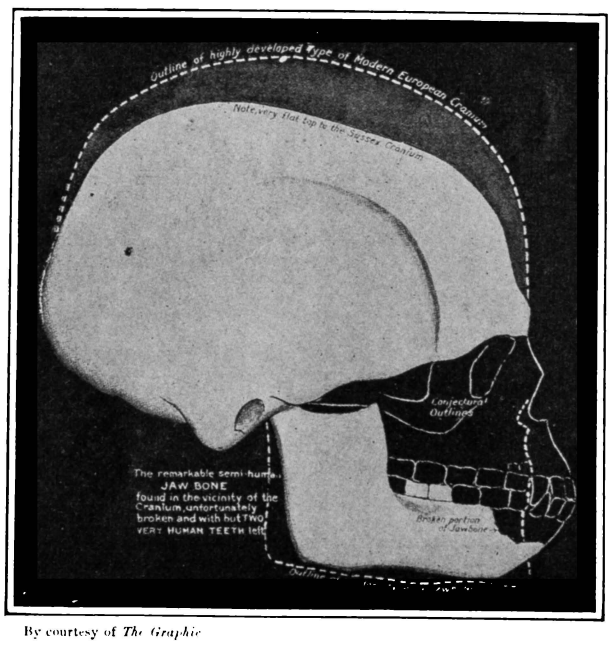
From a drawing by Forestier in *The Illustrated London News*

Fig. 4.—Reconstruction of the Sussex man.



From a sketch by Sir Ray Lankester in *The Daily Telegraph*

Fig. 5.—Sussex and other typical jaws compared.


Outline of highly developed type of Modern European Cranium
Note very that top to the Sussex Cranium
Conjectural Outlines
The remarkable semi-human JAW BONE found in the vicinity of the Cranium, unfortunately broken and with but TWO VERY HUMAN TEETH left

By courtesy of *The Graphic*

Fig. 6.—Skull of Sussex man compared with a highly developed modern type.

"Dr. J. Bernard Davis has proved, by many careful measurements, that the mean internal capacity of the skull in Europeans is 92.3 inches; in (native) Americans, 87.5; in Asiatics, 87.1; and in Australians, 81.9 inches. Prof. Broca found that the nineteenth century skulls from graves in Paris were larger than those from the vaults of the twelfth century in the proportion of 1484 to 1426."

Another feature which gives a characteristic measure of the stage of development reached is the facial angle. This has been given as 62 degrees in the Neanderthal man, 57.5 degrees and 67 degrees for two fossil specimens found at Spy, and 56 degrees in the highest apes. Modern man has a facial angle of 80 to 85 degrees. It is the low facial angle, the absence of chin, the prognathous jaw, and the prominent orbital ridges over the eyes which give a characteristic and brutal appearance to primitive man, as pictured for us by Mr. Forestier (Fig. 4).

The brain capacity of the Piltdown skull is estimated at 1,070 cubic centimeters (65.3 cubic inches). It is interesting to compare with this the size of brain of some of the largest and most highly developed apes; the brain of the gorilla reaches a capacity of some 34 cubic inches. In this respect, therefore, the Piltdown skull might be said to stand about half way between the gorilla and modern man—neglecting the fact that the gorilla is more massive in body than man. Nevertheless, the Piltdown skull represents a considerably higher type, it seems, than the Neanderthal race, which has a much more slanting forehead. It appears, therefore, that at least one very low type of man with a comparatively high forehead was in existence in western Europe long before the low-browed Neanderthal man became widely spread in this region. Dr. Smith Woodward, who has been associated with Mr. Dawson in his study of the Sussex skull, accordingly inclines to the theory that the Neanderthal race was a degenerate offshoot of early man and probably became extinct, while surviving modern man may have arisen directly from the primitive source of which the Piltdown skull provides the first discovered evidence.

One is naturally curious to know the age of the Sussex skull. The geologist is very cautious in estimating the age of fossils in years, but to make a very broad guess, it may be estimated that the Piltdown man lived some two or three hundred thousand years ago. Since that time the River Ouse has worn down its bed through a distance of eighty feet. The gravel bed in which the skull was found appears to belong to what the geologist terms the Lower Pleistocene age. The gravel consists largely of flints, among which many show signs of having been fashioned by human hands into rude implements. With the flints were discovered fragments of teeth of a Pliocene elephant and of a mastodon. Other remains were identified as belonging to a hippopotamus, a beaver, a horse, and part of the antler of a red deer.

Such are the facts of the case. For those who like to give free rein to their imagination, there is ample scope for exercise in picturing the eventful life of primitive man, battling with wild beasts long since extinct, and, no doubt, engaging also in fierce combats with fellows of his own kind; for the frequent signs of violent injuries found in various fossil specimens attest eloquently to the strenuous struggle for existence that prehistoric man had to wage.

The Atoll Cloud

THE low-lying coral islands of the Pacific would be difficult objects for the mariner to sight at a distance, but for a curious meteorological phenomenon connected with them, to which attention has recently been directed by William Churchill. In his monograph on "Easter Island," just published by the Carnegie Institution, he says (page 50): "Even in the region of the lowest atolls a sailor's eye can read in the sky at enormous distances the loom of the land. The lagoon of Anaa reflects the sunlight which shimmers on its unruffled surface and casts so distinct a green hue upon the trade-wind clouds which it creates that its existence may be known as far upon the sea as if it were piercing the heavens a mile high instead of lying on the waves scarcely as elevated as the seas which shatter in tumult on its reef."

The characteristic green cloud formed over an atoll Mr. Churchill has named elsewhere[1] the "atoll cloud." In a letter on the subject he gives further particulars:

"I have picked up this island (Anaa) perhaps a score of times, and the same holds true in varying degrees of other of the Tuamotu atolls. I recall the same observation of Jaluit in the Marshalls, of Liuenina (Ongtong Java) off the Solomon Islands, and possibly of yet another great atoll in the same neighborhood. My attention was first directed upon the phenomenon by Polynesian sailors, but as soon as the eye has once caught the appearance of the cloud in the sky it is thereafter as unmistakable as the loom of the land itself. I may describe it as a characteristic pale green tint upon a thin white (fleecy cumulus) cloud, the tint being nacreous, but not quite so pronounced as the shade of the California abalone shell.

"Anaa is a very typical instance. The lagoon is a still sea with much of its depth under two fathoms. The strand facing the lagoon is so flat that a ripple of no more than half a vertical inch will wet as much as fifty feet of sand. Water temperatures in the shallows have been noted between 35 and 37 deg. Cent. (95 to 98½ deg. Fahr.). I can find no record of sand temperatures on the beach, but you will see that they must run high, and, of course, they will prove a potent factor in evaporation when you recall what an acreage is dampened by the higher ripples and immediately exposed to evaporation under the hot sun. Physically we have no difficulty in seeing what happens. We have a large still surface of shallow water with a maximum of evaporating surface upon almost level beaches, a hot sun acting thereon, a flat land without elevations to interrupt the upward movement of convection. It may enter into the problem that this evaporating surface is surrounded by an ocean of cooler water. Evaporate this big pan, and you have an upward current of air carrying aqueous vapor up to the region where it becomes saturated, and, therefore, visible as a superimposed cloud. The still lagoon also serves as a mirror of many miles' area reflecting from its light green surface the rays of the sun."

The same process of rapid evaporation and convection over an island sometimes gives rise to a cloud below the general level of the trade cumuli and differing from the latter in direction and velocity of drift. This phenomenon is described in a letter from Lawrence Hargrave, the Australian inventor of the box-kite:

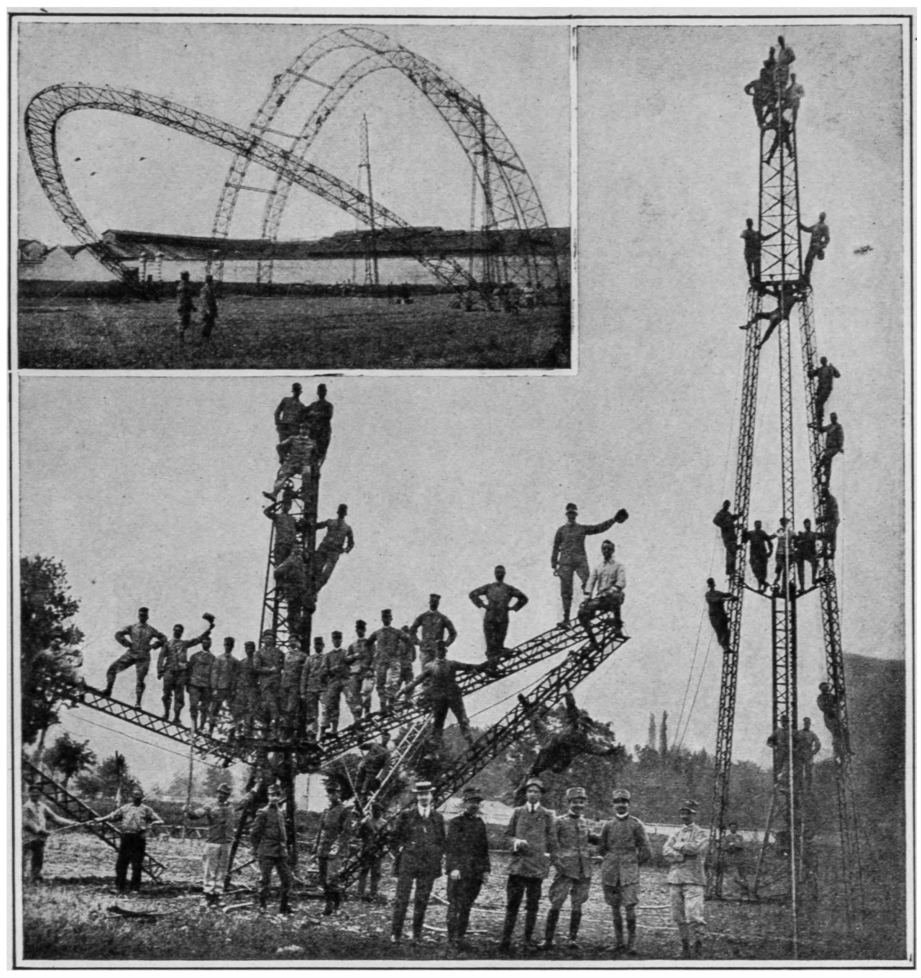
"Those who understand such things can often tell the position of an invisible reef or shoal by seeing a stationary cloud apparently ploughing its way through the ranks of the steadily moving trade clouds. If one be supposed to be above the clouds, this may be likened to a foam-flecked river passing a white stone projecting above the water. When there are no trade-wind clouds, a stationary cloud is still often an indication of reef, shoal, or island."

[1] Bull. Amer. Geogr. Soc., Oct., 1912, p. 784.

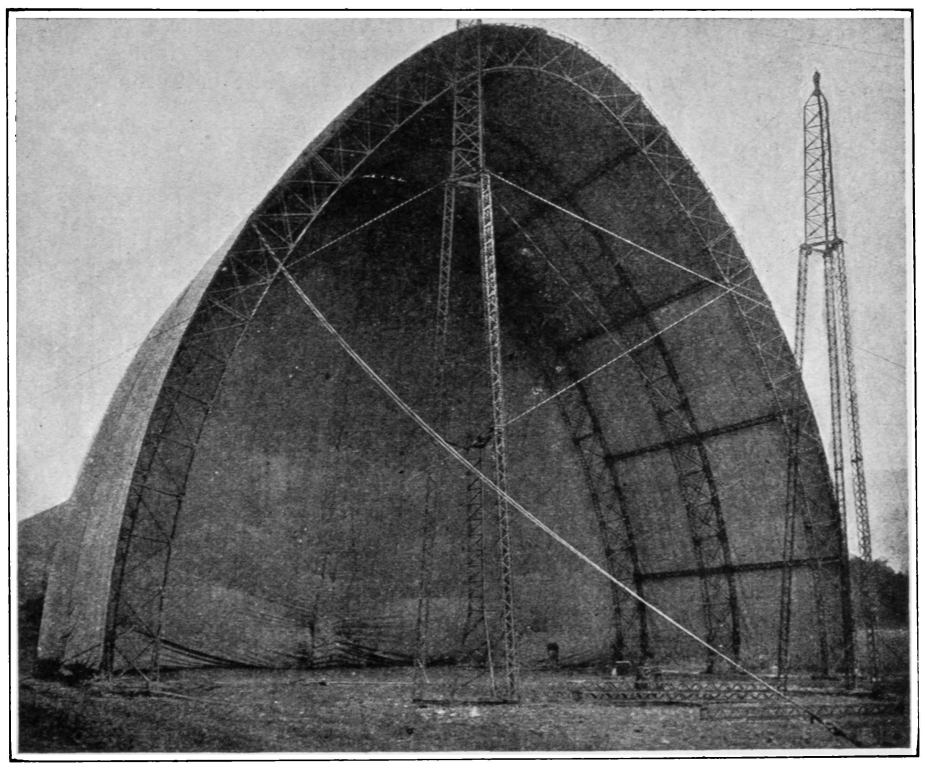
New Hangars for Military Uses

By Our Paris Correspondent

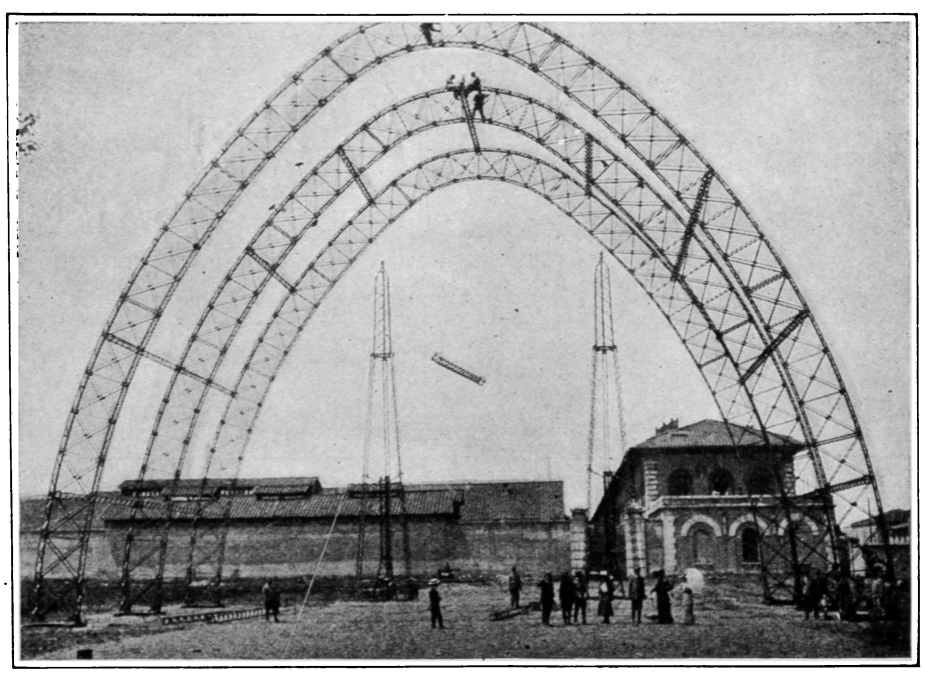
THE question of providing suitable hangars for airships is receiving much attention in military circles in the leading countries of Europe, in order to keep pace with the development of airships for army use. Such hangars may be divided into two general classes, one of these being a balloon shed of the fixed and permanent type which is erected once for all and belongs to certain military aeronautic establishments. Up to the present it is the permanent hangar which has received the greater share of attention on the part of designers and constructors, but not less important is the type of movable shed which is also needed as part of the army material in order to give a suitable shelter for airships when carrying out military operations in various places where they may be at a considerable distance from any of the permanent posts. The question of a portable hangar is also the object of research on the part of constructors, and we illustrate one of the most recent ideas of the kind which has been brought out in Italy, this being the Bosco and Donadelli system, and it is worthy of note for several reasons. As several of our engravings show, it has been tried in field work by the aeronautic corps of the army.



Arches in the course of erection. The pillars are built up of hinged sections.



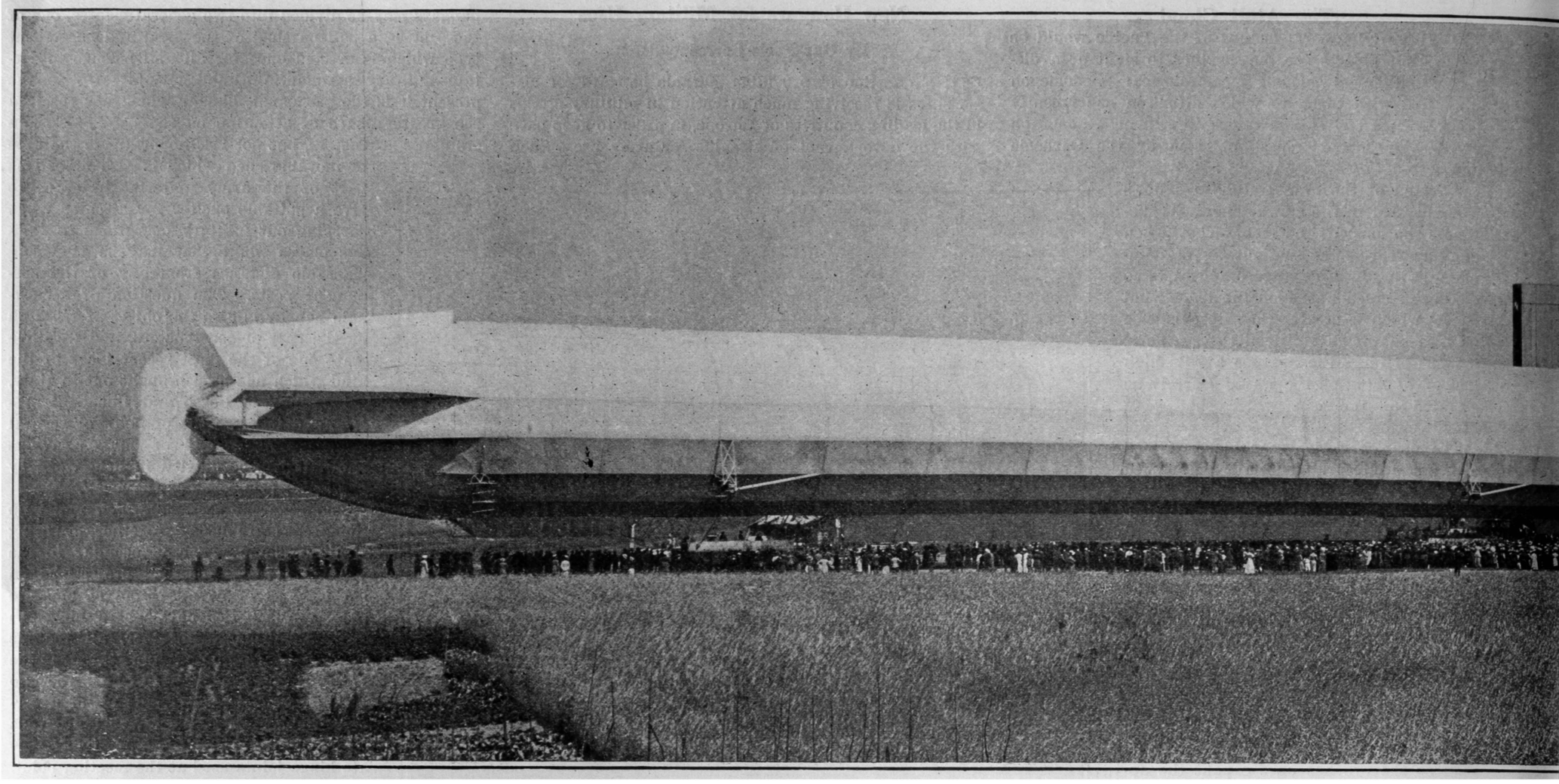
Metalized cloth is used as a covering.



Each arch is built up in sections on the ground and is then raised into position.

The different sections which make up the arches are locked together by using a hinge clamp which is peculiar to the present system. Toothed projections on one piece fit into recesses on the opposite piece like the two halves of a hinge, so that when placed together, all that is needed is to run a pin through the matched holes in order to couple the two pieces. Each arch is made up of a certain number of sections which are thus joined together, and there are two separate hinge joints used at the meeting point. After locking one joint as we have seen, this forms a hinge so as to bring the other joint into place, and it is then ready to be locked as before by means of a pin, so that the two sections are tightly fixed together by means of the two joints. To dismount the sections, the only operation needed is to withdraw the two locking pins so that the joints readily come apart. In this way the arch is built up while it is lying on the ground, and is then ready to be mounted in an upright position. At the proper points on the ground the base plates are laid which form the foot of the arch. Each plate carries projecting lugs in the shape of a half-hinge. These are made to match with a like part on the arch end so as to make the joint. After running a pin through the hinge while the arch is lying on the ground, the last is raised to the upright position by using ropes and pulleys, and when in place, the second joint between base-plate and arch now matches and this is fixed by driving in a pin, so that the arch is now fixed to the base-plate very strongly. The second arch is now raised in the same way, and the two are bound together by cross brace pieces of structural iron work as will be noticed, and so on until the right number of arches is erected.

Another point in the assembling of the hangar needs to be considered, this being the erecting of the structural iron poles or towers which are required in order to draw up the arches by means of cables. It has been a problem to set up such towers in the proper way in field work, as they must have a considerable height in order to serve for handling the arches and at the same time must be very strong in view of the great weight of the arch. The Italian constructors make use of the hinge joint principle in a very good way for mounting the towers. In the first place a short structural iron pole is fixed on the ground upon the base plate so as to form the lower and center part of the tower. It carries a set of pulleys at the top for use in raising the rest of the tower in place. The base plate is triangular, and at each end of the triangle a beam of the tower is fixed by means of a hinge joint. This beam is in reality double, having a hinge placed at the middle upon its height, but both sections of the beam can lie on the ground owing to the hinges. All three beams come together at the outer or top ends and are hinged to a single top pole or cap. The whole can be assembled with the sections lying on the ground with the exception of the top cap, which fits down over the middle post. When the hinge joints are



The "Zeppelin II" coming out of the great hang

assembled, the whole is drawn to an upright position by ropes and pulleys, and in this position the second joints between the various pieces all come together so as to be locked in place by pins, thus making a three-sided tower with its cap-piece, and the whole construction is very solid.

On dismounting the tower, the men climb to the top and draw out one of the hinge pins at each locking point, leaving one joint which acts as a hinge as before. The tower is then lowered as a whole in the same way as it was raised. All these operations can be carried out in a short time. When the first two arches have been raised and bound together, the tower is no longer essential, for the arch structure can now take its place so as to carry the ropes for raising the other arches of the hangar.

A new fabric is used for the covering material, comprising a metallized cloth which has great strength and is also weather-proof. It hangs down at each end of the hangar as a double curtain which can be drawn apart at the sides. The dimensions of the new military hangar of the present standard type are 270 feet length by 100 width and 80 height. A very good speed in mounting is assured, and all can be put together within two days. When transportation by railroad is necessary the metallic pieces with the covering and all needed parts are carried on a train of 20 cars.

An example of recent construction as regards the other class of hangars, that is the permanent balloon sheds, is shown in the type which has been erected at Cologne by the Augsburg-Nürnberg machine firm in order to house the Zeppelin airships. This hangar is noteworthy as being one of the largest of the military balloon sheds yet to be erected. One of the points which occupied the designer's attention was the operating of the large double doors at the end of the hangar. In spite of the great size of these doors, a suitable method of electric motor drive enables them to be opened in 4 or 5 minutes. The total length of the present hangar is very nearly 500 feet, its width 170, its height 92. The double doors are 82 feet high, and each door is 24 feet wide.

Cost Estimates of Horse and Motor Trucks

By John Ritchie, Jr.

As noted in the SCIENTIFIC AMERICAN of June 22nd last a careful study of comparative costs of vehicles is being made at the Massachusetts Institute of Technology, under the supervision of Dr. Harold Pender, and the dire management of research-associate H. F. Thomson. T researches of the Institute during the past summer and f have been in the nature of an inquiry into tire costs, repa costs and other expense matters, and are reported in Vehi Research Bulletin No. 2. Some notion of the amount work involved in the research may be gained from t statement of Mr. Thomson that more than one hundr thousand observations have been taken upon the perfor ance of wagons engaged in their daily work upon the stre and roads, not only in Boston, but in New York, Chica Philadelphia, Washington, St. Louis, and Detroit, as w as in a number of smaller places within the same expar of country. There have been thousands of tapes fr registering devices and other thousands of corroborate observations, attesting the facilities of the Institute collecting and digesting such scientific material.

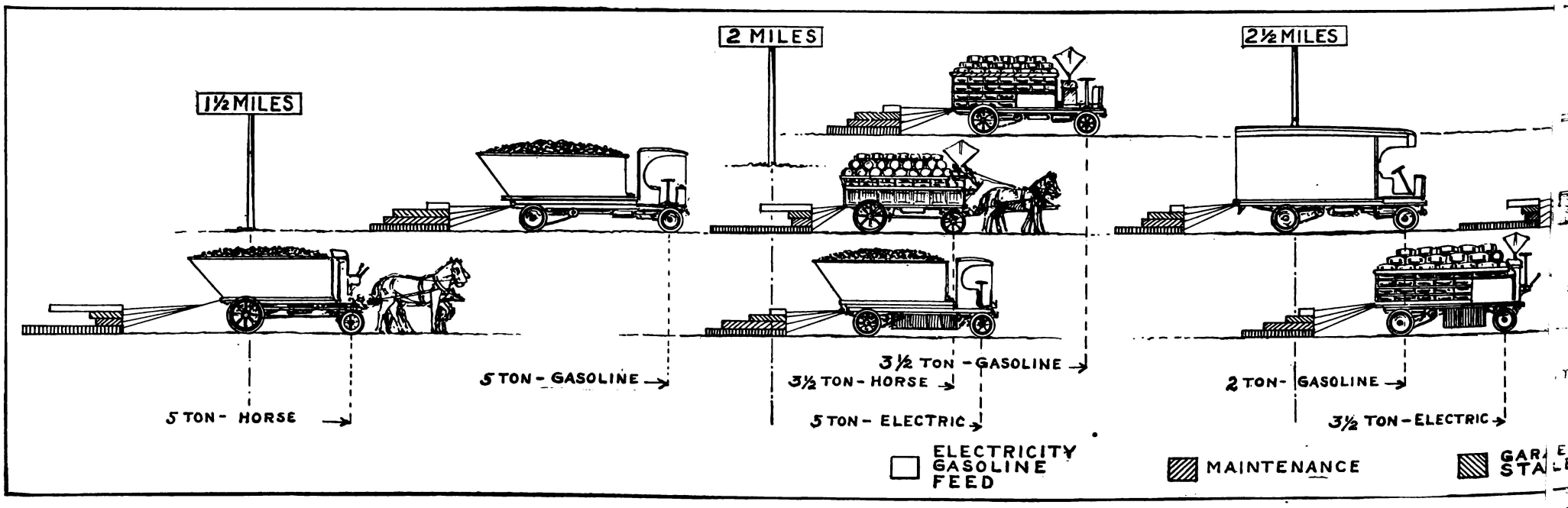
It is practically impossible to pre-determine what will the total annual cost of operating a truck at given rat without knowing what will be the requirements of the s vice, the nature of the road, and the general method handling and repairing for the cars. To illustrate difficulties involved in making up such an estimate, accompanying table has been prepared, showing the re tions between the various items of expense and the char ter of the work to be done, the nature of the roads a climate, and the system of operation.

In the expense for tire renewals the bulletin places average mileage cost for the five-ton electric at abou cents and for a five-ton gasoline about 9 cents, the co sponding data for the three-ton car being 3½ cents an cents. Several of the light gasoline cars which have b reported, have been equipped with pneumatic tires, wh which cases the mileage cost was as much as twice t for the solid tire equipment on the machines of the s

Relations Between Annual Cost of Motor Trucks And Characteristics of Service.

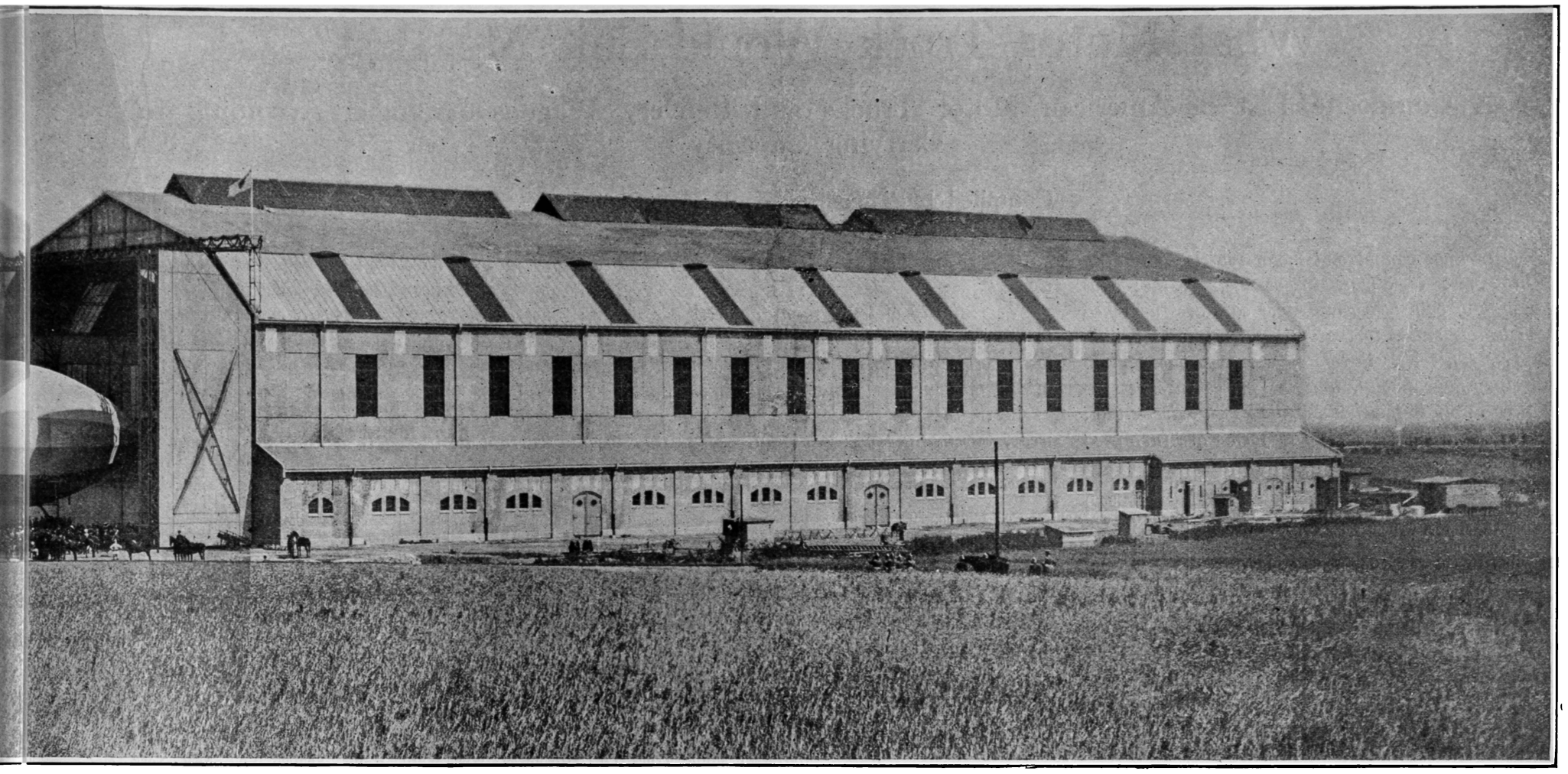
	Tires	Repairs	Battery Renewals	Lubricants	Electricity or Gasoline	Garage Expense	Sundries	Driver and Helper	Amortization or Depreciation	Interest	Insurance	Administration and Taxes
(a) Character of work:												
Size and type of truck	x	x	x	x	x	x	x	x	x	x	x	x
Nature of loads	x	x	x		x		x	x	x		x	
Number of cars	x	x	x	x	x	x	x					x
Distance per day	x	x	x	x	x				x			
Number of stops per day		x	x	x	x				x			
Days in service	x	x	x	x	x	x		x				
(b) Roads and climate:												
Road surface	x	x	x		x				x			
Grades		x	x		x				x			
Other street traffic		x	x		x						x	
Climate	x		x	x	x		x					
(c) System of operating:												
Routing	Indirectly as this item affects distance											
Loading and unloading	Indirectly as this item affects distance											
Overloading	x	x	x	x	x			x	x			
Overspeeding	x	x	x	x	x			x	x			
Garage facilities		x	x		x	x	x		x		x	x
Care of cars	x	x	x	x	x			x	x			x

Table showing by x's what service conditions affect the various expense items.



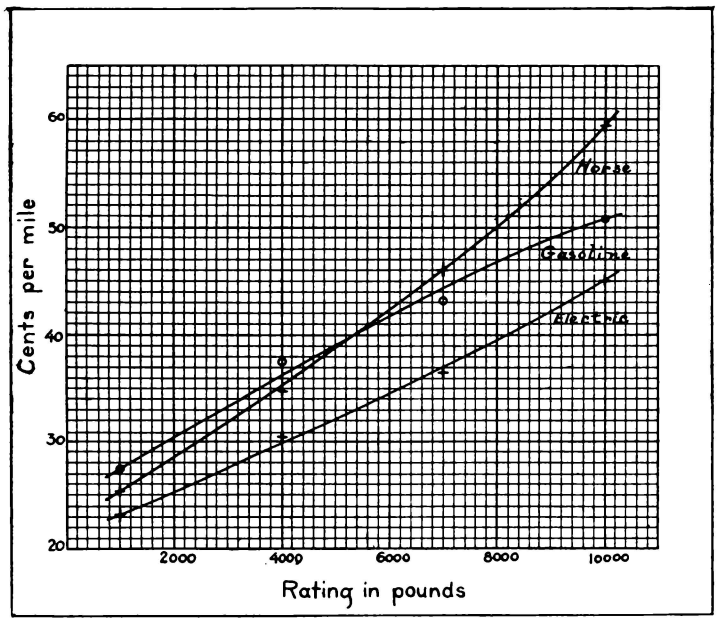
The trucks have run as far as they can on one dollar. The distances they have covered may be judged f

A dollar race, based on estimates compiled by the Mas



gne—one of the largest of its kind in existence.

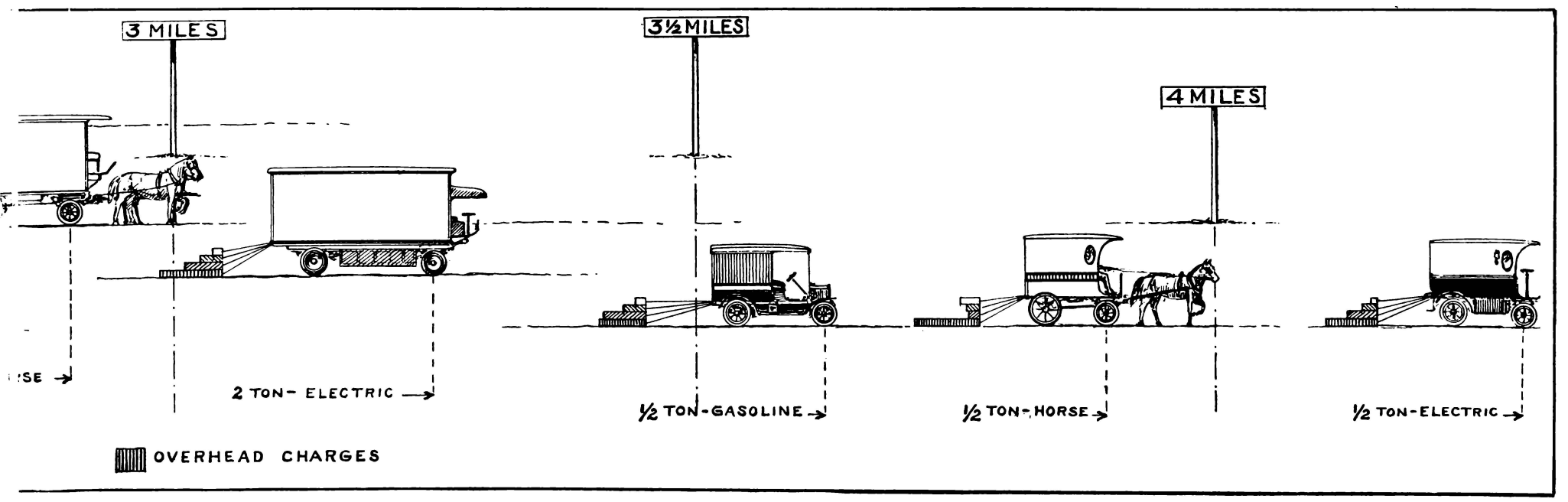
Referring to the reports upon the apparent repair e, it is found that for the electric truck, this expense ctically as great for the large cars as for the small In the small sizes the reports in special cases show considerably in excess of that commonly referred car manufacturers. With the gasoline machine the expense in the majority of cases where the car has gone a thorough overhauling is far in excess of the facturer's figures, the average being from one and a o two times as great. The reports for garage ex- are very irregular, ranging all the way from $13 a o $459, and averaging about $200 per year. The aver- onsumption of electricity for electric trucks with lead ies, ranges from about 500 watt hours per mile for ght delivery wagon to about 1,200 watt hours for the n truck. The number of miles per gallon of gaso- aries from three to four miles for the four, five and ton machines, to about nine miles for the light cars. r estimates have been made whose details are based the performance study (the full results of which are not yet ready for publication) and upon the cost ation presented in Vehicle Research Bulletin No. 2. otal comparative expenses per delivery as given in estimates are plotted against the size of the truck in ccompanying chart. The respective curves for the gasoline and electric wagon indicate that the power s have an increasing superiority over the horse wagon n increase in size. The vehicles chosen for the esti- are of one thousand, four thousand, seven thousand en thousand pounds rated capacity, respectively em- t in parcel, furniture, draft beer and coal delivery. erritory covered in each case is assumed to be within miles of the loading point. The expense items have grouped under the head of (1) electricity, gasoline, d; (2) maintenance, including tires or shoeing, repairs, battery, veterinary, lubricants; (3) garage or stable, driver and helper; (4) overhead charges, including depreciation, interest and insurance. The accompanying drawing is based on these estimates and shows the comparative distances that can be covered by the various types of vehicles at an expenditure of $1. Each vehicle is dragging behind it its load of expenses per mile, the separate bars of the load, representing fuel, maintenance, garage or overhead charges, as indicated by the legend. The cars have all started from a common starting point, and before the half-ton electric vehicle has run up one dollar's worth of expenses, it has covered a distance of four and one third miles, while for the same outlay of money, the five-ton horse-drawn coal truck has covered but a mile and two thirds. The other vehicles are distributed between these limits, as shown in the drawing. In these estimates, the expense for electricity has been placed at 3 cents per kilowatt hour, that of gasoline at 16 cents per gallon and of feed at $190 per head per year. As shown in the chart the total expense per mile for the half-ton electric vehicle is 23 cents. How this amount is divided up into the various items of expense is indicated by the length of the bars constituting the load that drags behind the vehicle. The same is true of all the other vehicles. The expense loads are all drawn to the same scale, so that it is a simple matter to compare any vehicle with any other, by measuring the relative lengths of the bars.



Estimates of total expense of 1-ton parcel, 2-ton furniture, 3½-ton keg-beer and 5-ton coal trucks.

Testing Eggs by Roentgen Rays

A LARGE association of English poultrymen, which delivers 200,000 eggs per week to London merchants, has for some time made successful commercial use, according to *La Technique Moderne*, of the Roentgen ray apparatus for testing the freshness of eggs. The lamp is inclosed in a box impervious to light except on one side, in whose wall an opening proper for the reception of the egg is made. An absolutely fresh egg, when placed therein, appears perfectly transparent. Eggs which are older, even if still edible, show small spots. These are not visible to the naked eye by ordinary light, but are shown on the fluorescent screen of the apparatus quite clearly. When such spots exceed a certain size the egg is declared unfit for food. These "examined eggs," which are certified by a stamp, are already much sought after in the London market.



posts. Dragging behind the vehicles are bars indicating the expenses charged *per mile* against each truck.

stitute of Technology for short distance truck service.

What Motor Truck Would Suit Me Best?

A Composite List of American Motor Trucks and Delivery Wagons Arranged According to Carrying Capacity

Compiled by Theodore M. R. von Kéler

TO arrange commercial motor vehicles according to price is almost impossible, as the great majority of both heavy and light cars are furnished with bodies suited to the special needs of the purchaser. This list, therefore, has been based upon the carrying capacity, and the prices in most instances apply to the chassis, fitted with driver's seat.

Bodies in a great variety of forms are furnished by the manufacturers at prices ranging from $100 upward.

The majority of truck manufacturers are willing to sell to small merchants on easy payments, and to supervise the installation of motor service by means of their own service departments.

As in the list of pleasure cars published last week, the many small companies of purely local importance have been omitted, and only the leading models have been listed. Besides the factories named herein there are nearly one hundred companies which have been formed within the last six months, and whose prospective output will not fall short of 5,000 trucks during the coming year. As yet their product has not reached a stage which would warrant its listing in a national periodical.

Capacity 500 to 1,000 Pounds.

Anderson Elec. Car Co., Detroit, Mich. ($2,345)
Bessemer Motor Truck Co., Grove City, Pa. ($1,250)
Bowling Green Motor Car Co., Bowling Green, O. ($1,200)
Chase Motor Truck Co., Syracuse, N. Y. ($500)
Commerce Motor Car Co., Detroit, Mich. ($750)
Dart Mfg. Co., Waterloo, Iowa. ($750)
Durant-Dort Carriage Co., Flint, Mich. ($750)
General Vehicle Co., Long Island City, N. Y. ($1,370)
Hupp Motor Car Co., Detroit, Mich. ($950)
Ideal Auto Co., Fort Wayne, Ind. ($1,500)
McIntyre, W. H., Co., Auburn, Ind. ($600)
Mercury Mfg. Co., Chicago, Ill. ($750–$900)
Moon, J. W., Buggy Co., St. Louis, Mo. ($1,150)
Studebaker Corp., South Bend, Ind. ($1,500)
Sullivan Motor Car Co., Rochester, N. Y. ($925)
U. S. Motor Co., Detroit, Mich. ($1,400)
Ward Motor Vehicle Co., New York city. ($1,200)
Waverly Co., Indianapolis, Ind. ($1,800)

Capacity from 1,001 to 2,000 Pounds.

Adams Bros. Co., Findlay, Ohio. ($2,100)
Alden-Sampson Mfg. Co., Detroit, Mich. ($2,000)
Anderson Elec. Car Co., Detroit, Mich. ($2,870)
Atterbury Motor Car Co., Buffalo, N. Y. ($1,500)
Available Truck Co., Chicago, Ill. ($900–$1,350)
Avery Co., Peoria, Ill. ($2,000)
Bessemer Motor Truck Co., Grove City, Pa. ($1,800)
Bowling Green Motor Car Co., Bowling Green, O. ($1,600)
Brown Commercial Car Co., Peru, Ind. ($1,650)
Buick Motor Co., Flint, Mich. ($1,000–$1,400)
Chase Motor Truck Co., Syracuse, N. Y. ($1,250)
Chicago Pneumatic Tool Co., Chicago, Ill. ($1,050)
Croce Auto Co., Asbury Park, N. J. ($1,850)
Dart Mfg. Co., Waterloo, Iowa. ($1,100)
Durant-Dort Carriage Co., Flint, Mich. ($1,375)
General Vehicle Co., Long Island City, N. Y. ($1,710)
Gramm Motor Truck Co., Lima, O. ($1,750)
Harwood-Barley Mfg. Co., Marion, Ind.
Hexter Motor Truck Co., Lima, O. ($1,750)
Hupp Motor Car Co., Detroit, Mich. ($750)
Ideal Auto Co., Fort Wayne, Ind. ($1,750–$2,000)
International Motor Co., New York city. ($2,500)
Kelly-Springfield Motor Truck Co., Springfield, O. ($2,000)
Kissell Motor Car Co., Hartford, Wis. ($1,500)
Knickerbocker Motor Truck Mfg. Co., New York city. ($2,000)
Koehler, H. J., Co., New York city. ($750)
Krebs Commercial Car Co., Clyde, O. ($1,375)
Lauth-Juergens Motor Car Co., Fremont, Ohio. ($2,100)
Lippard-Stewart Motor Car Co., Buffalo, N. Y. ($1,650–$1,675)
McIntyre, W. H., Co., Auburn, Ind. ($1,500)
National Motor Truck Co., Bay City, Mich. ($1,225)
Nyberg Automobile Works, Anderson, Ind. ($1,300)
Oakland Motor Car Co., Detroit, Mich. ($1,500)
Piggins Motor Truck Co., Racine, Wis. ($1,750)
Pope Mfg. Co., Hartford, Conn. ($1,750)
Poyer, D. F., Co., Menomimee, Ind. ($1,200–$1,500)
Reo Motor Truck Co., Lansing, Mich. ($750)
Rowe Motor Mfg. Co., Coatesville, Pa. ($1,700–$2,100)
Sandusky Motor Truck Co., Sandusky, Ohio. ($1,400)
Sanford Motor Truck Co., Syracuse, N. Y. ($1,660)
Selden Truck Sales Co., Rochester, N. Y. ($2,000)
Service Motor Car Co., Wabash, Ind. ($1,350–($1,475)
Stewart Motor Corp., Buffalo, N. Y. ($1,650)
Studebaker Corp., South Bend, Ind. ($2,000)
Sullivan Motor Car Co., Rochester, N. Y. ($1,050)
Transit Motor Truck Co., Louisville, Ky. ($1,850)
Universal Motor Truck Co., Milwaukee, Wis. ($1,950)
Velie Motor Vehicle Co., Moline, Ill. ($2,000)
Ward Motor Vehicle Co., New York city. ($2,000)
Waverly Co., Indianapolis, Ind. ($2,150)
White Co., Cleveland, O. ($2,100)
Wilcox Motor Car Co., Minneapolis, Minn. $2,300)

Capacity from 2,001 to 3,000 Pounds.

Adams Bros. Co., Findlay, Ohio. ($2,300)
Alden-Sampson Mfg. Co., Detroit, Mich. ($2,500)
Anderson Electric Car Co., Detroit, Mich. ($3,132.50)
Atterbury Motor Car Co., Buffalo, N. Y. ($2,300)
Auto Car Co., Ardmore, Pa. ($2,150)
Bessemer Motor Truck Co., Grove City, Pa. ($2,100)
Blair Mfg. Co., Newark, O. ($3,000)
Bowling Green Motor Co., Bowling Green, O. ($1,850)
Chase Motor Truck Co., Syracuse, N. Y. ($1,750)
Croce Auto Co., Asbury Park, N. J. ($2,500)
Dart Mfg. Co., Waterloo, Iowa. ($1,800)
Federal Motor Truck Co., Detroit, Mich. ($1,800)
Four-Wheel Drive Co., Clintonville, Wis. ($3,600)
General Motors Co., Detroit, Mich. ($2,075)
Grand Rapids Motor Truck Co., Grand Rapids, Mich. ($2,200–$2,500)
Harwood-Barley Mfg. Co., Marion, Ind. ($2.000)
Ideal Auto Co., Fort Wayne, Ind. ($2,250)
International Motor Co., New York city. ($2,750)
Juno Motor Truck Co., Juneau, Wis. ($2,200)
Knickerbocker Motor Truck Mfg. Co., New York city. ($2,250)
Krebs Commercial Car Co., Clyde, O. ($1.775)
Mais Motor Truck Co., Indianapolis, Ind. ($2,750–$2,800)
McIntyre, W. H., Co., Auburn, Ind. ($2.300)
Moon, J. W., Buggy Co., St. Louis, Mo. ($1,900)
Piggins Motor Truck Co., Racine, Wis. ($2,250)
Reo Motor Truck Co., Lansing, Mich. ($1,800)
Rowe Motor Mfg. Co., Coatesville, Pa. ($2,850)
Sanford Motor Truck Co., Syracuse, N. Y. ($1.910)
Service Motor Co., Wabash, Ind. ($1,675)
Studebaker Corp., South Bend, Ind. ($2,950)
Transit Motor Truck Co., Louisville, Ky. ($2,300)
Universal Motor Truck Co., Milwaukee, Wis. ($2,750)
U. S. Motor Co., Detroit, Mich. ($2,200)
Walter Motor Truck Co., New York city. ($2,800)
White Co., Cleveland, O. $3,000.
Wilcox Motor Car Co., Minneapolis, Minn. ($2,500)

Capacity from 3,001 to 4,000 Pounds.

Adams Bros. Co., Findlay, Ohio. ($2.500)
Alden-Sampson Mfg. Co., Detroit, Mich. ($2,800)
American Locomotive Co., Schenectady, N. Y. ($2,950)
Atterbury Motor Car Co., Buffalo, N. Y. ($2,650)
Avery Co., Peoria, Ill. ($2,700)
Chase Motor Truck Co., Syracuse, N. Y. ($2,200)
Croce Auto Co., Asbury Park, N. J. ($2,850)
Garford Co., Elyria, O. ($2,800)
General Motors Co., Detroit, Mich. ($2,750)
General Vehicle Co., Long Island City, N. Y. ($2,090)
Gramm-Bernstein Co., Lima, O. ($2,750)
Gramm Motor Truck Co., Lima, O. ($2,600)
Harwood-Barley Mfg. Co., Marion, Ind. ($2,500)
Hexter Motor Truck Co., Lima, O. ($2.600)
Ideal Auto Company, Ft. Wayne, Ind. ($2,500)
International Motor Co., New York city, N. Y. ($3,000)
Juno Motor Truck Co., Juneau, Wis. ($2,800)
Kissell Motor Car Co., Hartford, Wis. ($2,750)
Knox Auto. Co., Springfield, Mass. ($3,000)
Lauth-Juergens Motor Car Co., Fremont, O. ($2,800)
Mais Motor Truck Company, Indianapolis, Ind. ($2,950–$3,000)
Mogul Motor Truck Co., Chicago, Ill. ($2,750)
Packard Motor Car Co., Detroit, Mich. ($2,800)
Packers Motor Truck Co., Wheeling, W. Va. ($2,675)
Piggins Motor Truck Co., Racine, Wis. ($2,750)
Reo Motor Truck Co., Lansing, Mich. ($1,950)
Rowe Motor Mfg. Co., Coatesville, Pa. ($3,100)
Smith, A. O., Co., Milwaukee, Wis. ($3,000)
Speedwell Motor Car Co., Dayton, O. ($2,850)
Sternberg Motor Truck Co., Milwaukee, Wis. ($2,800)
Studebaker Corp., South Bend, Ind. ($3,300)
Suburban Truck Co., 1420 Chestnut St., Philadelphia, Pa. ($2,750)
Transit Motor Truck Co., Louisville, Ky. ($2,850)
Universal Motor Truck Co., Milwaukee, Wis. ($2,750)
Velie Motor Vehicle Co., Moline, Ill. ($2,850)
Walter Motor Truck Co., New York city. ($3,000)
Ward Motor Vehicle Co., New York city. ($2,900)
Waverly Co., Indianapolis, Ind. ($3,000)

Capacity from 4,001 to 6,000 Pounds.

Alden-Sampson Motor Car Co., Detroit, Mich. ($3,400)
Atterbury Motor Car Co., Buffalo, N. Y. ($3,350)
Avery Co., Peoria, Ill. ($3,200)
Blair Mfg. Co., Newark, O. ($3,250)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($3,500)
Croce Auto Company, Asbury Park, N. J. ($3,600)
Federal Motor Truck Co., Detroit, Mich. ($2,800)
Four-Wheel Drive Co., Clintonville, Wis. ($4,000)
Garford Co., Elyria, O. ($3,500)
Gramm Motor Truck Co., Lima, O. ($3,500)
Harwood-Barley Mfg. Co., Marion, Ind. ($3,200)
Hexter Motor Truck Co., Lima, O. ($3,500)
International Motor Co., New York city, ($3,750)
Juno Motor Truck Co., Juneau, Wis. ($3,400)
Kelly-Springfield Motor Truck Co., Springfield, O. ($3,400)
Kissel Motor Car Co., Hartford, Wis. ($3,350)
Knickerbocker Motor Truck Mfg. Co., New York city. ($3,500)
Knox Automobile Co., Springfield, Mass. ($3,700)
Lauth-Juergens Motor Car Co., Fremont, O. ($3,450)
Mais Motor Truck Co., Indianapolis, Ind. ($3,400)
McIntyre, W. H., Co., Auburn, Ind. ($3,200)
Packard Motor Car Co., Detroit, Mich. ($3,400)
Peerless Motor Car Co., Cleveland, O. ($3,700)
Piggins Motor Truck Co., Racine, Wis. ($3,000)
Rowe Motor Mfg. Co., Coatesville, Pa. ($3,400)
Standard Motor Truck Co., Detroit, Mich. ($2,750)
Service Motor Car Co., Wabash, Ind. ($2,475)
Sternberg Motor Truck Co., Milwaukee, Wis. ($3,400)
Universal Motor Truck Co., Milwaukee, Wis. ($3,400–$3,500)
U. S. Motor Co., Detroit, Mich. ($3,400)
Velie Motor Vehicle Co., Moline, Ill. ($3,350)
Victor Motor Truck Co., Buffalo, N. Y. ($2,750)
Walter Motor Truck Co., New York city. ($3,400)
White Co., Cleveland, O. ($3,700)
Wilcox Motor Car Co., Minneapolis, Minn. ($3,250)
Wyckoff, Church & Partridge, New York city. ($4,750)

Capacity from 6,001 to 8,000 Pounds.

Alden-Sampson Motor Car Co., Detroit, Mich. ($4,250)
American Locomotive Co., Schenectady, N. Y. $3,650)
Anderson Elec. Car Co., Detroit, Mich. ($5,000)
Blair Mfg. Co., Newark, O. ($3,750)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($4,400)
Garford Co., Elyria, O. ($3,850)
General Motors Co., Detroit, Mich. ($3,500–$3,750)
General Vehicle Co., Long Island City, N. Y. ($2,620)
Gramm-Bernstein Co., Lima, Ohio. ($3,600)
International Motor Co., N. Y. city ($4,250)
Kissel Motor Car Co., Hartford, Wis. ($3,650)
Knickerbocker Motor Truck Mfg. Co. ($4,000)
Mogul Motor Truck Co., Chicago, Ill. ($3,800)
Packers Motor Truck Co., Wheeling, W. Va. ($3,500)
Peerless Motor Car Co., Cleveland, O. ($4,000)
Smith, A. O., Co., Milwaukee, Wis. ($3,750)
Speedwell Motor Car Co., Dayton, O. ($3,750)
Sternberg Motor Truck Co., Milwaukee, Wis. ($4,000)
Studebaker Corp., South Bend, Ind. ($3,500)
Transit Motor Truck Co., Louisville, Ky. ($3,500–$3,750)
Walter Motor Truck Co., N. Y. city. ($3,750)
Ward Motor Vehicle Co., New York city. ($3,400)
Waverly Co., Indianapolis, Ind. ($3,500)
Wyckoff, Church & Partridge, New York city. ($5,250)

Capacity from 8,001 to 10,000 Pounds.

Aires Motor Truck Co., N. Y. city. ($5,250)
Alden-Sampson Motor Car Co., Detroit, Mich. ($4,750)
American Locomotive Co., Schenectady, N. Y. ($4,750)
Atterbury Motor Car Co., Buffalo, N. Y. ($4.250)
Avery Co., Peoria, Ill. ($4,500)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($5,000).
Croce Auto Co., Asbury Park, N. J. ($4,500)
Garford Co., Elyria, O. ($4,500)
General Motors Co., Pontiac, Mich. ($4,400)
General Vehicle Co., Long Island City, N. Y. ($2,950)
Gramm Motor Truck Co., Lima, O. ($4,500)
Hexter Motor Truck Co., Lima, O. ($4,500)
International Motor Co., New York city, N. Y. ($4,800–$5,000)
Kissel Motor Car Co., Hartford, Wis. ($4,350)
Knickerbocker Motor Truck Mfg. Co., New York city. ($4,500)
Lauth-Juergens Motor Car Co., Fremont, O. ($4,500)
Locomobile Co. of America, Bridgeport, Conn. ($4,800)
McIntyre, W. H., Co., Auburn, Ind. ($4.200)
Packard Motor Car Co., Detroit, Mich. ($4,500)
Peerless Motor Car Co., Cleveland, O. ($4,500)
Pierce-Arrow Motor Car Co., Buffalo, N. Y. ($4,500)
Piggins Motor Truck Co., Racine, Wis. ($3,800)
Rowe Motor Mfg. Co., Coatesville, Pa. ($4,500)
Sternberg Motor Truck Co., Milwaukee, Wis. ($4,500)
Studebaker Corp., South Bend, Ind. ($4,250)
Transit Motor Car Co., Louisville, Ky. ($4,500)
U. S. Motor Co., Detroit, Mich. ($4,750)
Victor Motor Truck Co., Buffalo, N. Y. ($3,650)
Walter Motor Truck Co., N. Y. city. ($4,500)
Waverly Co., Indianapolis, Ind. ($4,000)
White Co., Cleveland, O. ($4,500)
Wyckoff, Church & Partridge, New York city. ($5,750)

Capacity from 10,001 to 14,000 Pounds.

Aires Motor Truck Co., N. Y. city. ($6,000)
American Locomotive Co., Schenectady, N. Y. ($5,200)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($5,600)
Garford Co., Elyria, O. ($4,850)
General Motors Co., Detroit, Mich. ($4,400)
Hexter Motor Truck Co., Lima, O. ($4,750)
Hydraulic Truck Sales Co., N. Y. city. ($5,500)
International Motor Co., New York city. ($5,300–$6,000)
Mogul Motor Truck Co., Chicago, Ill. ($4,400)
Smith, A. O., Co., Milwaukee, Wis. ($4,750)
Speedwell Motor Car Co., Dayton, O. ($4,400)
Transit Motor Truck Co., Louisville, Ky. ($4,500)
Victor Motor Truck Co., Buffalo, N. Y. ($3,650)
Walter Motor Truck Co., N. Y. city. ($5,000)
Wyckoff, Church & Partridge, New York city. ($6,250)

Capacity Over 14,000 Pounds.

Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($6,200–$6,550)
International Motor Co., New York city. ($5,300–5,800)
Studebaker Corp., South Bend, Ind. ($4,750)

New-York Life Insurance Co.

346 Broadway, New York

SIXTY-EIGHTH YEAR OF BUSINESS

To the Policy-holders:

Your Directors assume that, when you think of your contract with this Company, you never question the Company's soundness, but that you are deeply interested in its progress, and in the efficiency and economy of its management.

We submit, therefore. the following summary from the transactions of the year:

During 1912 the Company received in premiums	**$85,941,784.05**
In Interest, Rents, etc.	**33,301,582.53**
Total Income	**$119,243,366.58**

INVESTMENTS MADE DURING YEAR

Real Estate Mortgage Loans (first lien) made in 46 Cities located in 25 States and Countries (to yield 5.32%)	$34,916,046.00
State, County and Municipal Bonds (domestic, including Canada) issued by 49 Counties and Municipalities located in 20 States (to yield 4.47%)	7,463,101.77
Domestic Railroad Bonds (to yield 4.56%)	3,820,791.17
Foreign R. R., Gov't and Municipal Bonds (to yield 4.21%)	8,234,223.13
Miscellaneous Bonds (to yield 4.73%)	266,777.50
Loaned to policy-holders on security of their policies (to yield 5%)	27,763,909.00

DURING 1912 THE INSURED OR THEIR BENEFICIARIES RECEIVED FOR

Death Claims	$25,788,714.50
Matured Endowments	6,167,076.79
Surrendered Policies	12,959,576.80
Dividends	11,436,686.36
Annuities	1,570,502.77
Added to the reserve funds for insurances, to meet the standard adopted by the Company, in accordance with the law, and to the reserve funds for future dividends	31,019,826.00

The increase in the earning power of the Company's assets during the last seven years is equal to 0.29%. Translated into dollars this means an increase in earning power, over 1905, of more than TWO MILLION DOLLARS.

The increased earning power developed in 1912 is notable. It is represented by 9 100 of 1%, and, if maintained, will increase the income of the Company in 1913 by comparison with what it would have been had the earning power remained as at the close of 1911, by the sum of - - - $647,000

Of the amount which the law allowed us to spend in 1912 for new business, we actually spent . . . 91%
Of the amount which the law allowed us to spend for all purposes, we spent approximately 63%
Of the amount of new business which the law allowed us to issue in 1912, we issued 100%

NINETEEN-TWELVE WAS A GOOD YEAR

IF YOU DESIRE FURTHER DETAILS, WRITE THE HOME OFFICE, 346 BROADWAY, NEW YORK.

January 8, 1913.

Darwin P. Kingsley

President

Rumely Bulletin No. 7

EASIER FARMING MEANS CHEAPER FOOD

Power-Value of Horse and Tractor (1 to 30)

The most urgent and important problem in the development of industry, is EASIER FARMING.

The Farmer must have a higher percentage of result. He must be able to handle more land and to handle it in a more efficient way.

EASIER FARMING—that is the platform of the RUMELY COMPANY.

For sixty years this Company has made Power-Farming machinery.

The famous OilPull Tractor was born in the Rumely factories.

So were the other Rumely engines, and hullers, and tank wagons and separators. All told, there are now

51 RUMELY MACHINES

These Rumely Machines are all designed to cut down the cost of living. They mean cheaper bread and cheaper meat.

Whether you are a farmer or not, you should know the House of RUMELY.

RUMELY PLOWING HULLING AND THRESHING REG. U.S. PAT. OFF.

Rumely Products Co.

(Incorporated)

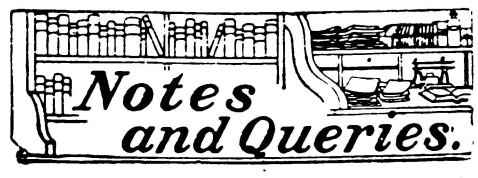
Power-Farming Machinery

La Porte, Ind.

See next week's Bulletin

381

Santa Fe de=Luxe
"America's finest train"
Chicago and Los Angeles-Winter Season
Extra fast - extra fine - extra fare
For travelers to and from California who wish ideal service.
The dining-cars are under management of Fred Harvey.
En route you can visit the Grand Canyon of Arizona
On request will send our booklets telling about a delightful journey to winterless California, through the Southwest Land of Enchantment.
W. J. Black, Pass. Traffic Mgr. A.T.&S.F.Ry. System.
1099 Railway Exchange, Chicago.
California Limited
Exclusively for first-class travel-The year 'round
Santa Fe
All the way



Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

12726) F. W. M. asks: An upright, tight, heating drum, 5 feet high, 8 inches diameter, having 2½-inch top connection (no damper) to chimney, and inside, on bottom of drum, a ring burner of 1-inch pipe for gas, with Bunsen air mixer taking air from outside, and also a 2-inch bottom connection to take in fresh air into drum. The gas will not burn in the ring burner inside of drum. It blows out. Why? A. If your Bunsen burner has a greenish color at the bottom of the flame and vibrates and snaps out, there is not sufficient air furnished by the mixer. There should be an adjustment to control the amount of air admitted to the gas, so that the burner will burn quietly and with a flame almost colorless when seen in a lighted room.

(12727) J. W. asks: I would very much like to know if there is any truth in a certain French chemist, who states that he has made the diamond in the rough. Some time ago I read in an editorial (have forgotten whether it was in your paper or some other paper) of its being done, and told it to a friend, who claims it cannot be done. I would be very much obliged if you would let me know about it. A. You are not misinformed that diamonds have been made artificially. The process is described in SUPPLEMENTS 1551, 1552, 1553, price ten cents each, in a lecture by no less an authority than Prof. William Crookes. These stones are very small, however, the largest being about three thousandths of an inch across. They are conceded to be real diamonds, and if small ones can now be made, perhaps some time large ones may be made. The "certain French chemist" is none other than the famous Moissan; the man who has almost created the use of the electric furnace. We should say there is truth in any claim he may make.

(12728) P. M. asks: 1. Why the sun appears to set at an earlier hour, say about December 16th than it sets December 21st or 22nd, the winter solstice. A. The sun sets just as long *after noon* as it rises *before noon* all the time, every day in the year. The clock, however, does not stand at 12 at noon on any day of the year, with the exception of four days, about April 15th, June 14th, September 1st, and December 24th; but the dates vary a little from year to year, partly because of the extra day inserted in leap years. The subject is too extensive for discussion in a letter, and is explained in all the text-books of astronomy under the caption "Equation of Time." You can doubtless in your city library find Todd's "New Astronomy," or Young's "Manual of Astronomy," either of which will cover the subject. 2. Why is it that at certain seasons the sun rises later every day, but, at the same time, sets at the same hour and minute, over a period of say 8 or 10 days? A. Your second question is answered by saying that sunrise and sunset are calculated and given in the almanacs for the real sun, but the clocks do not keep the time of the real sun, since the apparent motion of the real sun is not uniform day by day. Hence the apparent difficulty, which is explained in Todd, on page 113, under the heading "Retardation of Sunset near the Winter Solstice." Should you wish to own either or both of these valuable books, we can furnish Todd's "New Astronomy" for $1.45, and Young's "Manual" for $2.50, and shall be pleased to receive your order. We thank you for your expression of appreciation of our astronomical articles.

(12729) F. M. asks: How are trees splintered by lightning? Not long ago I examined the result of lightning on a large tree. Some large limbs that lay on the ground showed that each small twig and limb had a hole bored its length just under the bark. I could not find any entrance or exit holes, but cutting showed this one hole in the section, and charring was not in evidence. I took several of the sticks home, but cannot find them now. When the current gathered at the trunk, it was too much for the carrying capacity, and splintered the wood in seeking an onward path, and the limbs fell. Was not the tree's conductivity the sole cause for the effects? Had the tree been dead and dry, it would have been splintered much worse. Lightning follows the fiber, whether the tree is dead or alive, straight in the limbs and more or less spirally in the trunks. The great Maxwell believed heat, light, and electricity to be the same, i. e. vibratory. Why could not the vibrations of electricity crowd themselves on a poor conductor sufficient to tear it apart? A. We thank you for your observations upon the action of an electric discharge upon the wood of a tree. All non-conductors are ruptured by the dissipation of a heavy charge of electricity upon or through them. The trees and wood generally form no exception to this general effect. Conductors are not thus affected, since they allow the dissipation to take place without resistance on their part. The better a non-conductor, that is, the poorer a conductor a material is, the more it is rent into pieces by an electric shock. Light, heat, and electricity are regarded by scientists as manifestations of one energy, differing principally in wave length. All these are electro-magnetic effects. Lightning only differs in the magnitude of its display.

PATENT ATTORNEYS

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & COMPANY

361 BROADWAY, NEW YORK

Branch Office, 625 F Street, Washington, D. C.

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Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AEROPLANE

THE "AUTOMATON." Constructed on Scientific principles and self-balancing. Duplex Motor power and interacting duplex controls. Automatic parachute of instant action, for commercial and military purposes. The inventor seeks to interest a moderate amount of capital. Address O. C. P. O. Box 773, N. Y.

AGENTS WANTED

AGENTS—Ask us about our snappy household specialty line that will clear you $50 to $80 weekly. American Aluminum Co., Division 1029, Lemont, Ills.

BUSINESS OPPORTUNITIES

PATENTS FOR ENGLAND. Licenses negotiated amongst first class British Firms for successful American Inventions patented in England. Address C. W. Dimes, A.M.I.C.E., 120 Thornlaw Road, West Norwood, London S.E., England.

PATENTABLE INVENTIONS on machinery and musical instruments *to order*. 30 years experience—correspondence solicited. George B. Durkee, M. E. 1934 Washington Boulevard, Chicago.

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LEARN JEWELERS' ENGRAVING. Taught thoroughly by mail. Beginners learn better engraving from us in six months than in years of rigid apprenticeship. Catalog free. Engraving School, Department 89, Page Bldg., Chicago.

PATENTS FOR SALE

SILENT TYPEWRITER. No. 1,048,878. Deadens noise of impact, prevents perforation of paper, increases speed, saves manifolding power, fits any machine. Leo Ranney, 414 W. 118th Street, N. Y.

PATENT NO. 1,012,849, "Collapsible Door" wood or steel, best patent for fire-shutters. Outright or royalty. For particulars address H. Hedwall, 186 Center Street, Quincy, Mass.

U. S. Patent on Ratchet Wrench. Useful tool for everybody. Will work where others fail. For further information address William G. Ruscoe, Box 65, Stamford, Conn.

U. S. PATENT NO. 1,011,806 for sale. Tool for using wire as binding twine, handles lumber, etc. For further particulars write C. T. Jordan, Allen, Alabama.

PATTERN LETTERS

PATTERN LETTERS AND FIGURES. White Metal and Brass, for use on patterns for castings. Largest variety, prompt shipments. Send for catalog. H. W. Knight & Son, 92 State St., Seneca Falls, N. Y.

WANTED

LOCAL REPRESENTATIVE WANTED. Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. National Co-Operative Realty Company. H-378 Marden Building, Washington, D. C.

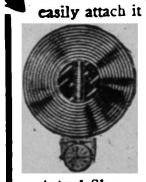
MISCELLANEOUS

MODEL AND FINE CLOCK TRAIN WORK. Estimates given. Work done by the hour or by contract. Waltham Clock Company, Waltham, Massachusetts.

$2.50 per day paid one man or woman in each town to distribute free circulars and take orders for concentrated flavoring in tubes. Permanent position. For further information address J. S. Ziegler Co., 447 F, Dearborn Street, Chicago

HALSEY THERMOSTAT HEAT REGULATOR

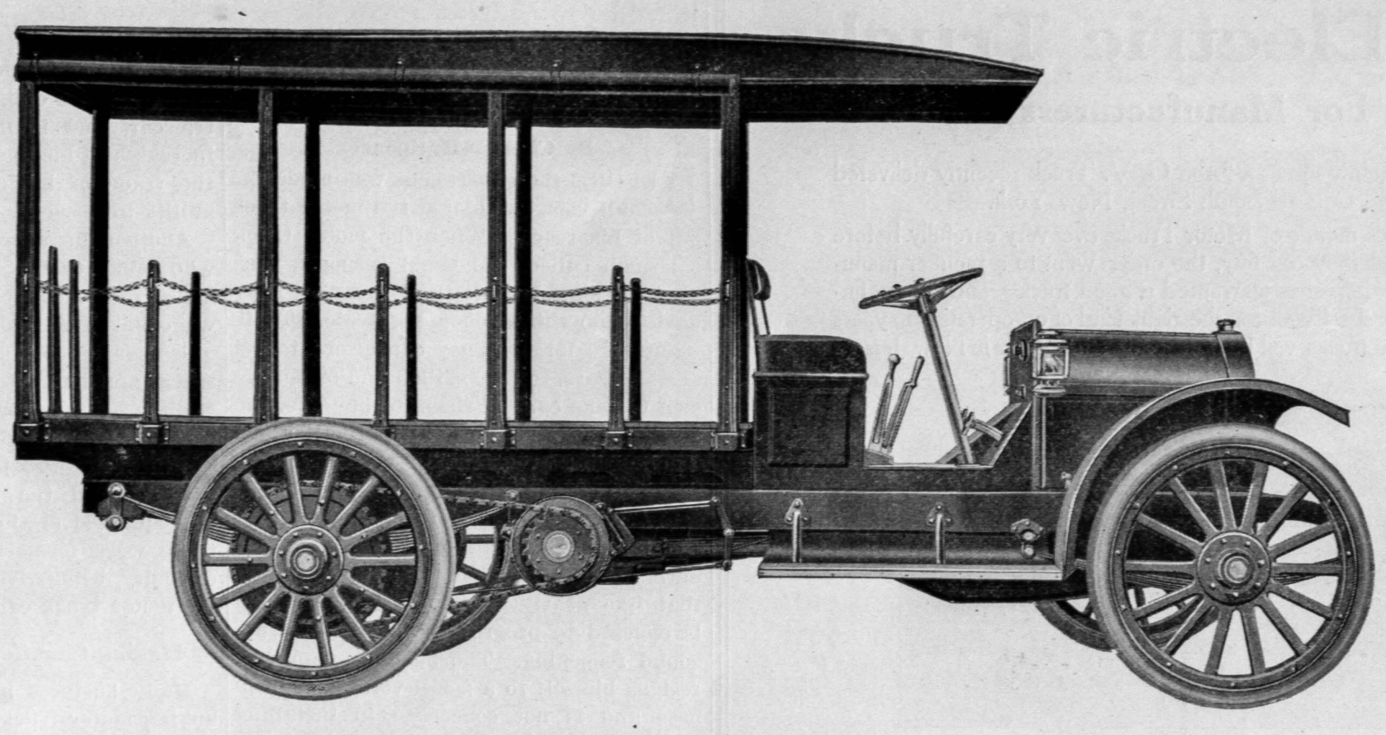
Keeps temperature even, saves coal, relieves you of all necessity for tending to heater dampers. So simple that anyone can easily attach it to steam, hot water or air heater—has no electrical contact, no batteries, no springs or weight-motor to get out of order. Costs within the reach of all. Guaranteed for ten years. Operates dampers gradually—securing maximum heat with minimum fuel cost. **Time attachment** automatically warms up house in the morning. Write for **Proposition "C"** - explains how you can get the Halsey Thermostat at half price.



Actual Size 9 in. in Diameter

W. W. HOGLE Sales Manager 1213 Filbert St., Phila.

DEALERS WANTED—advertising helps furnished free.



The ¾ Ton Utility Truck—$1250

(*Chassis Only*)

THIS new Utility truck is the most practical and serviceable truck of its size ever built. It is intended for any kind of city and suburban delivery service. It works more simply, more economically, more rapidly and more effectively than most trucks of much larger size. It is a new development.

Unlike the average small truck, it is *not* a built-over or a redesigned pleasure chassis. It is a real heavy truck in all of its parts, in its entire design, in its whole construction and in its economical operation. For instance, the powerful 4-cylinder motor is controlled by our patented governor; it cannot be driven over 18 miles an hour; it has quick demountable solid tires 36" x 3" front and 36" x 3½" rear; it has an unusually rugged pressed steel frame, doubly reinforced at points where it will receive the greatest strains; the wheel-base is 120 inches.

Throughout this truck is built on the most modern truck lines. It is made in one of the largest truck plants in the world by men who have been building successful trucks for over ten years. It is built by truck specialists.

For the merchant or manufacturer who has a whole lot of daily deliveries to be taken care of, this new Utility truck is well worth immediate investigation.

See the nearest Gramm dealer, or write us and we will send you one of our transportation experts.
Literature and transportation advice from the factory—gratis.

See this new truck at the Chicago Truck Show
Section D, Coliseum

The Gramm Motor Truck Company, Lima, Ohio

John N. Willys, President

BRIEF SPECIFICATIONS

CARRYING CAPACITY—1500 lbs. Maximum, 2000 lbs.

BODY—Optional and extra.

FRONT AXLE—1-Beam Section. Timken bearings.

REAR AXLE—Rectangular Section, Timken bearings in hubs.

MOTOR—4 cylinders, 4 in. bore—4¼ in. stroke. Provided with enclosed and sealed governor.

TRANSMISSION—Selective type. Three speeds forward and one reverse.

WIDTH OF FRAME—34 inches

WHEEL BASE—120 inches.

TIRES—Front, 36x3, Rear, 36x3½. Goodyear Solid.

LOADING SPACE — Approximately, 48 inches x 96 inches.

GASOLINE CAPACITY — 20 Gallons.

EQUIPMENT—Two side oil lamps. Oil tail lamp, horn, and full set of tools.

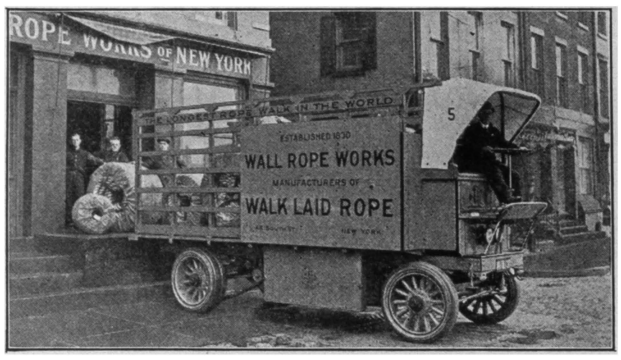
GENERAL VEHICLE GREATEST VALUE

G. V. Electric Trucks

For Manufacturers

The illustration below shows a 5-ton G. V. Truck recently delivered to the Wall Rope Co., 48 South Street, New York.

They thought this matter of Motor Trucks over very carefully before buying, and when they did buy, the order went to a pioneer manufacturer whose experience warranted a good truck—and whose financial standing argued well for the right kind of co-operation in years to come. Other trucks will be ordered for the works in New Jersey.



We recently delivered a similar 5-ton truck to the Central Stamping Co. of New Jersey and another to the National Sugar Refining Co. The General Electric Co. uses 47 G. V. Trucks in its various plants. Other users are—The A. B. See Elevator Co., Brown & Sharpe, Pacific Mills, Canadian Rubber Co., Colgate & Co., Globe Wernicke Co., Jenney Mfg. Co., Mosler Safe Co. (winch equipped), National Cash Register Co., Singer Mfg. Co., Standard Paint Co., Winchester Repeating Arms Co., Manning, Maxwell & Moore, and many others.

It is a great mistake to ignore G. V. Trucks for moving goods because they ought to be saving the manufacturer thousands of dollars per year. We have nine customers ***who haven't a single horse.*** One of them sold 176 horses in three years.

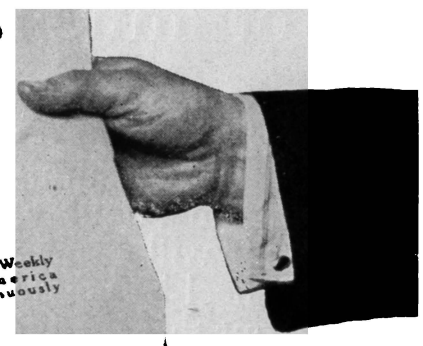
Catalogue 101 and other information on request.

The General Vehicle Co., Inc.

Long Island City, New York

New York Chicago Boston Philadelphia St. Louis

Leslie's
THE PEOPLE'S WEEKLY



The Oldest Illustrated Weekly Newspaper in America Published Continuously Since 1855

Facts every *Scientific* advertiser should know

What periodicals gained and lost circulation.

Comparative gain and loss. *Actual circulation figures* year by year for each of fifteen leading publications, for four years.

Amount of advertising carried *month by month* for the past four years by these periodicals.

Gains and losses for 1911 compared with 1908.

Number of consumers reached for one cent with the same sized advertisement by each of 24 national media.

And about *Leslie's*—

How many retailers in each line subscribe—

How much circulation in public reading places—

How much in homes—

Each subscriber's occupation—

Number of copies that go to each town —Newsstand distribution, etc.

These Facts are in the Leslie Book of Facts—

These books cost over $5.00 to prepare. One will be sent gratis to any *national* advertiser or agency sending this coupon request.

Allan C. Hoffman
Advertising Director
225 Fifth Avenue, New York

COUPON

1-18-13 (S.A.)

Allan C. Hoffman
225 Fifth Ave.
New York

Please send me Leslie Book of Facts.

Name .....

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Address .....

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Connection.....

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Business Getters for Small Concerns

By Charles H. Spencer

BEFORE the experiment was made the small user considered the motor truck out of his reach. When the motor truck salesman called, the usual response was, "Let the big fellow do it. We can't. They have to do things on a big scale. Their plants are large. They can afford to get fleets of cars, to hire skilled and expensive men to take care of them, to buy gasoline at reduced rates, and to profit all along the line by purchasing in volumes, reaping the benefit of cost reduction by so doing." There seems to be plausibility and business discretion in this argument until analyzed. Then it will be found that like nearly every proposition which is opposed to progress it is based on unsound reasoning. The business man who resigns himself to a small volume of business and is not concerned in installing facilities for handling an increase, is never likely to get the increase.

Customers Beyond the Horse's Reach.

The city merchant not equipped with the commercial vehicle is now finding himself compelled either to abandon the efforts to secure the business in the suburban trade, or to expend a sum of money on horses and suitable wagons that consume his profit and make his venture unprofitable. The man using horses has to limit himself to the area in which the animal has to deliver. Farther than this the country is closed to him. There may be thousands of customers beyond the boundary line of the horse's power. It is generally agreed that a ten-mile radius is about the limit in which it is possible to use a horse-drawn delivery system. By the time a horse has hauled a load for ten miles, made many stops and completed the ten-mile journey back, it has done about all the work possible for him. When any more than twenty miles daily is piled on the animal it is done at a risk, it means perhaps the collapse of the horse, a dead loss to the owner, and permanent impairment of his delivery system.

The electric vehicle ideally adapted to quick delivery within the city limits or to suburban points is good for a radius of from twenty to twenty-five miles a day going and coming, and finally a gasoline propelled motor truck is in many instances delivering at distances of fifty miles from its starting point, which means that it covers a delivery route of one hundred miles a day.

A Wholesale Grocer's Experience.

A short time ago the writer's attention was called to a wholesale grocer who decided he did not have enough customers to support the overhead expenses of his store. He decided to create a small field of action, and for this reason he picked out a truck. He was prepared to have it cost him a little more money, just as he believed in spending additional money for advertising, or increasing the salary of a productive salesman. The results he obtained were very prompt in forthcoming. His truck went where his wagon never before could reach, and he found that there was business waiting in sections he little dreamed of. He put on more salesmen, who in this way were given the advantage of being able to promise prompter deliveries than they had been able to maintain before. The increase was so rapid, and the profit so big, that this particular grocer was obliged to put a new truck into service to care for the gain.

We know of a similar instance with a small retail ice concern that was competing with a large concern using horse-drawn vehicles. In less than a year's time after introducing a commercial truck, he was obliged to purchase an extra car, and is now making wonderful increases in his business, and inroads into the trade of his competitor through his ability to serve his patrons more promptly.

Another instance is of a retail grocer who found that a 1½-ton commercial vehicle displaced four horses and two wagons. This concern averages sixty miles per day now by the use of the motor truck, and has extended the business territory of the company to a surprising degree. New customers have been made, and held by the promptness of delivery assured, and the residences situated in unfrequented sections are reached, where these were formerly a problem of great difficulty, being visited weekly, where now the motor truck calls daily.

Making Chauffeurs Out of Drivers.

Many business men are deterred from buying motor trucks for fear their wagon drivers cannot learn to be chauffeurs. There is no more intelligence required to operate and take care of a car than to take proper care of a horse. There are a few motor truck manufacturers who conduct special schools for drivers at their different service buildings located in the various large cities of the country, and it is their experience that the average teamster can be readily educated to operate a car. One concern turned out last year over fourteen hundred students in one of these schools, who were formerly drivers and reliable delivery men used in the days of the horse-drawn vehicle.

The Right Car for the Purpose.

It has been found in many instances that a merchant has paid too little for his motor truck, or has purchased a car too light in construction to withstand the daily delivery grind, or too large for the particular handling of his merchandise. There are over two hundred and sixty firms engaged in the manufacture of motor trucks in this country, and it requires little effort to secure practically all the needed information regarding the particular type of truck that is meeting with success in the line of business in which the merchant is interested. On looking carefully into the subject, it is usually to be found that the best car for a particular line of business, is the type that is already represented in greatest numbers in that line.

Steel Tires in France

To the Editor of the Motor Truck Department:

In the article on Subsidized Motor Trucks appearing in your issue of Sept. 28th, 1912, a statement was made which was very misleading for the reason that it was incomplete. It referred to the French government test, and the assertion was made that "not one of the trucks shod all around with steel was able to qualify." The author evidently did not know that this applied only to trucks of three tons capacity and less, in other words, light trucks intended to be driven at speeds of about twenty miles per hour. Thomas S. Fay, former president of the American Society of Automobile Engineers, who carefully investigated the French army test of steel tire trucks, said: "Not a few makers of automobiles maintained that pneumatic tires would be even cheaper and better in the long run than solid rubber tires, thus suggesting strongly that steel tires were out of the question. But the French army had its way and their decision has had a marked influence on commercial transportation in France. Today practically all French trucks over three tons capacity are fitted with steel bands in place of solid rubber tires." Similar tests have resulted in the adoption

If You Are Mechanically Inclined

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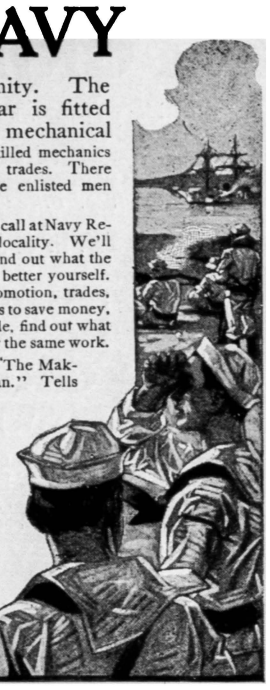

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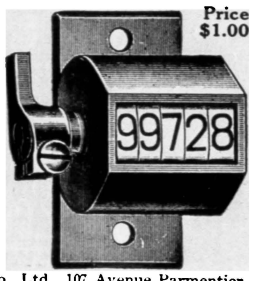

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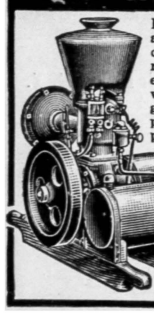

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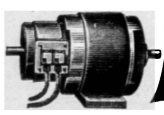

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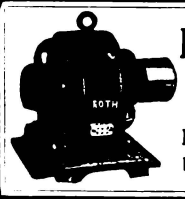

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Abuse of Good Roads

By Arthur C. Brady

MUCH is written and a great deal of gossip is current regarding the abuse inflicted on good roads by the automobile.

The writer has made several personal examinations of new roads that have been opened and finds that the trouble charged to the automobile in this respect is very much exaggerated. The evidence seems to point to the fact that it is a combination of horse and automobile which interferes with road conditions.

In a recent walk of five miles over a new State road, opened only about a year ago between Millbrook and Poughkeepsie, the evidence was conclusive throughout the entire distance that it was the sharp calks of the horse-shoes that started the deterioration. This road had been covered with some oil substance which had made a very compact smooth surface and which was capable of shedding water. This surface was not broken or damaged in any way by the automobile service traveling over it, although a speed of 50 miles an hour is not unusual on this road. The print of every horse-shoe was distinct, however, and the calk cut through this cover, making an opening where the water finds its way through, thus giving a hold for the automobile tire to pick up small particles of dust and start an opening which soon grew to a size requiring attention.

It is always easier to point out the difficulty than find the remedy. Unless horses can be driven over State roads with rubber shoes, they are a great detriment to the wearing qualities; and in view of the fact that we are spending millions of dollars every year for good roads, I think it is worth consideration to look the matter straight in the face, and either arrange to build roads that will stand both horse and automobile wear, or equip horses used for road work with shoes that will not penetrate to a depth of $\frac{1}{4}$ inch as the calks do where newly shod horses are traveling at a fast gait.

Motor Truck Queries and Answers

J. P. B. asks: Will the next few years bring many changes in the design and construction of commercial motor vehicles?

A. This is a question frequently asked by prospective users, and their failure to secure a convincing answer is probably delaying many from purchasing motor vehicles. Practically every motor truck engineer will assert that the changes will be limited principally to minor refinements and improvements, which will make the vehicles of to-morrow but little better than those of to-day. Irrespective, however, of what the future may hold in store, the motor truck of to-day is a highly developed and very practical transportation unit, and no unjustified fears of radical changes in the future should influence those debating its adoption.

A. L. P. asks: Is there any advantage in the motor truck with the motor in front under a hood, as in pleasure cars, over the truck with the motor under the seat?

A. With the motor under the driver's seat it is possible to have a shorter wheel base and over-all length. Where a very long body is used or where many turns have to be made in narrow streets this is naturally an advantage. On the other hand, there are a number of advantages of steel tires for the motors used by the armies of Germany, Austria, Russia and Japan, and steel-tired trucks are now being introduced into this country. To adapt a motor truck for steel tires, particular attention must be paid to the spring suspension of the chassis. The springs must be unusually long and flat so that they will have a maximum of resiliency. They must also be hung in such a way as to permit of side sway. The wheels must have very thick felloes, and hubs of wood with many substantial spokes. Motor trucks thus constructed may safely be driven at speeds up to ten miles or even fifteen miles per hour.

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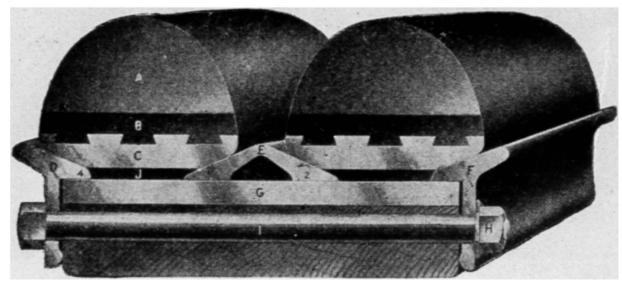

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United States Standard Demountable Tires have the well-earned distinction of being the most efficient motor truck tires on the market today.

This is an important statement to every business man who has a haulage problem on his hands.

Efficiency is the watch-word of the modern business and mechanical world today. The concerns which occupy the front rank are the concerns that have come the closest to making every man, machine and appliance throughout their organization 100% efficient.

Clearly this rule applies to the delivery and haulage departments as well as to the manufacturing division.

If you are compelled periodically to lay up your trucks and tie up your deliveries hours or days at a time while a wheel is away at some distant repair station for a tire replacement, you have a weak, inefficient spot in your delivery system that would not be tolerated a day if it occurred in a modern manufacturing plant.

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(DEMOUNTABLE)

have forever done away with inefficiency of this sort.

Here is a tire that can be replaced in your own garage by the driver himself after working hours. And it will take him only fifteen minutes to do the job (even for dual equipment).

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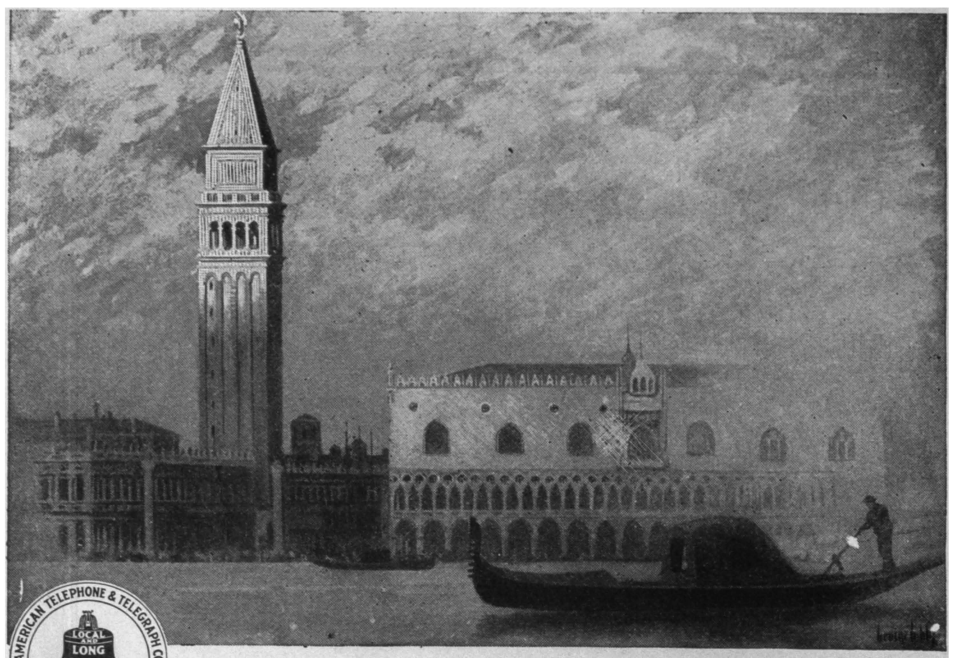

Seven Million Watch-Towers in the Bell System

The original campanili were the watch-towers of old Venice, guarding the little republic from invasion by hostile fleets.

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claimed for the motor in front under a bonnet. This construction brings more of the load weight on the rear axle, where it properly belongs and can be readily cared for, enabling the use of lighter spring suspension in front, where the power and driving mechanism is located, both of which need to be relieved of jar as much as possible. It provides easier handling of the vehicle and a more accessible power plant. In its new specifications pertaining to motor trucks eligible for subsidy the British War Department bars all vehicles not having motors in front.

IN the SCIENTIFIC AMERICAN of October 26th, 1912, was an article by Mr. Morris A. Hall on the delivery service of New York's department stores, in which it was stated that the saving of the trucks over horses was found by Stern Brothers to be $1,912 a year for each motor driven unit. The figure should have been $2,112.

Moving and Talking Pictures

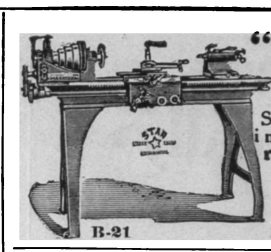
(*Concluded from page 64.*)

the film after exposure. The Court of Appeals for the Second Circuit (see 151, F. R., 167) held claims 1, 2 and 3 valid, but not infringed by a camera in which the film is moved by frictional contact alone, although such construction is within their terms if construed without reference to the words "substantially as described." But they held these claims were infringed by a camera in which the film is moved by a reciprocating two-tined fork carrying studs or pins which engage perforations along the edges of the film. This construction was considered the substantial equivalent of the sprocket wheel of the patent. Claim 4 was held void as too broad. It differed from claim 3 of the original by the additional words, "the periods of rest being greater than the periods of motion."

The reissued patent was again reissued as No. 13,329 with five claims. Claims 1, 2 and 3 thereof are the same as the corresponding claims of the previous reissue. Claim 4 differs from claim 1 in stating that the feeding devices comprise means proportioned to cause the devices to so advance the film that its periods of rest shall exceed its periods of motion. Claim 5 differs from claim 1 in stating that the film is perforated and specifying that the feeding devices are provided with teeth engaging the perforations of the intermediate section.

In a suit brought by the Motion Pictures Patent Company (owners of the Edison patent) against the Chicago Film Exchange, the validity of the reissued Edison patent was again passed upon. The lower court held the claim covering the photographic film infringed, but on appeal the decision of the lower court was reversed, the court taking the position that "the long, pliant, translucent, celluloid film with the sensitized surface was the invention and improvement of others. The pictures taken on such a film are photographs. . . . The invention of Edison was exhausted with the construction of a camera which enabled the photographs of moving objects to be taken on the Eastman film in the distinct, uniform, and satisfactory manner justly claimed for them. The pictures taken are the direct result of the mechanism of the camera with the Eastman film mechanically adapted to and applied thereto." The perforations along the edges of the film at regular intervals, into which perforations the teeth of ratchet wheels entered to give it the required motion, was regarded as a mere mechanical contrivance devoid of patentable novelty.

A large number of patents have been granted for various improvements in motion picture machines, and to describe them all would fill a large volume. An interesting apparatus was patented by R. D. Gray, No. 540,545, June 4th, 1895. Referring to Fig. 4 the film *D* is shown passing from the reel *I'* to the reel *I*. The film receives two series of exposures, the individual exposures being made alternately on opposite sides of the median line of the film and through a single lens



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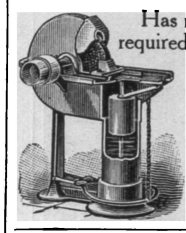

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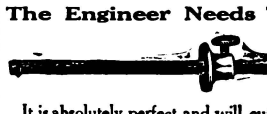

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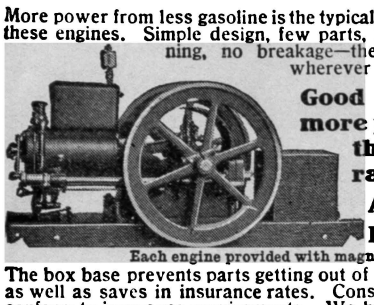

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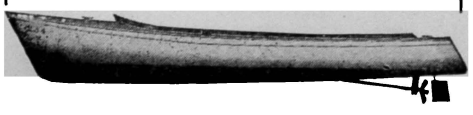
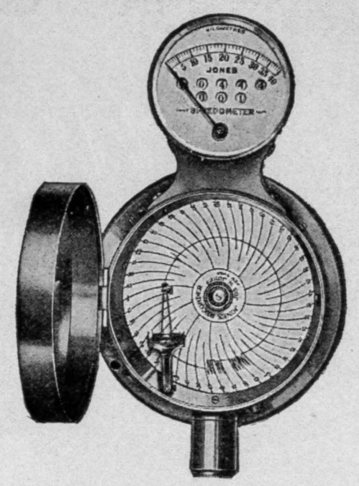


B. A segmental mirror *E* shown in elevation in Fig. 3 consists of a half circle of silvered glass, the other half of which is transparent. This mirror is rotatably mounted so that its plane of rotation intersects the axial line of the lens at an angle of forty-five degrees, and thus during each rotation the light is alternately allowed to strike the film at *C* and then reflected to strike it at *C'*. The film guides are so arranged that the exposures at *C* and *C'* are on opposite halves of the width of the film. The film is advanced intermittently by two rods *v* and *v'* operated by cranks, the free end of each rod being forked and the tines bent at right angles to engage perforations along each side of the film. The forks act alternately so that while the film is being exposed while at rest at one place it is being advanced at the other. For projection, a device similar to the camera is used with the addition of two lamps, one in the axial line of the lens opposite *C* and the other at right angles thereto opposite *C'*.

The motion picture machine and the phonograph have both reached a high degree of perfection. The next step is to connect the two machines so that they will operate in unison. Motion pictures unaccompanied by sound give the effect of pantomime. On the other hand, the effect produced by the phonograph alone is in many instances as unsatisfactory as the effect produced by a singer or speaker who cannot be seen by the audience. The combined effect of motion pictures and phonographic reproduction is necessary to give complete illusion. For this purpose substantially complete synchronism between the two machines is necessary in order that each movement shown upon the screen shall be accompanied by the sound originally produced simultaneously therewith. Attempts have been made to accomplish synchronism by mechanical connections between the two machines and also by connecting them electrically. It is claimed that mechanical connections are not effective since the slightest slip between the parts or any inaccuracy in construction destroys the synchronism. As for electrical connections, it has been stated the cost of equipment and maintenance of special electrical apparatus is prohibitive. Be that as it may, the fact remains that in spite of repeated efforts for a number of years, this feature has not as yet been placed on a practical commercial basis. Mr. Edison claims to have solved the problem in his recently exhibited kinetophone, but he is unwilling as yet to publish the technical details of construction. The patents along this line are all of rather recent date. The patent to Gaumont, 752,394, February 16th, 1904, discloses an example of synchronizing by electrical connections. Referring to Fig. 6, the phonograph *L* is driven at a constant speed by any desired motor *Z*. The motion picture machine *K* is driven by a motor which has the coils of rotor *B* connected to a source of electrical energy *I*, while each section of the stator *A* is connected with a section of the collector *C*. This latter connection consists of insulated wires formed into a cable *O*. Brushes *D* and *E* are rotated around the collector by the gearing *M N* connected with the phonograph. The said brushes are connected to insulated rings *x* in contact with brushes *d e*, connected to the two poles of a source of electrical energy *J*. When the brushes *D* and *E* are rotated, corresponding polarities are produced in the stator *A*, the law of displacement of which is the same as that of the brushes. Consequently, the rotor *B* will exactly follow the movement of the brushes which are positively driven from the phonograph. In operating this apparatus the phonograph is started with the motion picture machine disconnected. At the exact moment when a pre-arranged signal is given by the phonograph, the motion picture machine is started by means of the clutch *F*.

A MAN feels more responsible and self-respecting while attending to a machine than when acting the part of a chambermaid to a horse in a livery stable. —*The Power Wagon.*



Do You Know Actual Costs?

IF your price is too high, your competitor undersells you. If your price is too low, you undersell yourself. You lose, and your losses grow bigger with your business. Today the growing merchant has actual cost knowledge. His purpose in finding costs is to reduce them. Reliable figures of cost are always analyzed. They locate losses and wastes. Figures reduced to the language of costs usually shout loudly for reform.

Jones Recorder
for Motor Trucks

supplies accurate data to determine delivery costs. Motor trucks are big investments. Delivery costs arise out of the maintenance and depreciation of the trucks. The charges must be reduced to unit figures to be distributed to each unit of product. There is only one way—have complete performance records of every truck.

By the Jones Recorder every movement of the truck is registered on a graphic chart. Every operation of the truck is visualized. It tells every speed, all the distances covered, the number of stops made, the length of the delays, the time of each loading and unloading interval, and the time of departure and return.

Such reliable and immediate knowledge discovers leaks and permits every organization to move its goods efficiently. In connection with fuel, oil and tire consumption records over-all delivery costs are found, and when actual costs are known cost-reduction is usually effected.

The Jones Recorder is enclosed in a handsomely finished case of heavy brass. It is connected to a gear on the front wheel by flexible shafting. The rotation of the shaft actuates the chart and recorder to obtain accurate cost-reducing records for your trucks.

We would be glad to supply more complete information.

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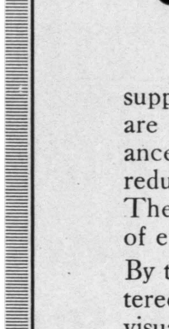
Plants: Bush Terminal, Brooklyn, N. Y., New Rochelle, N. Y.



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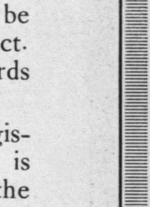

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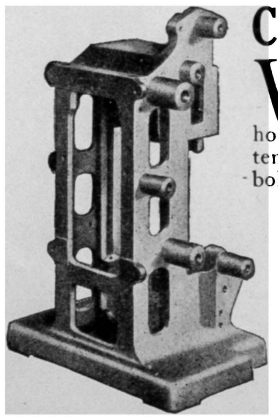

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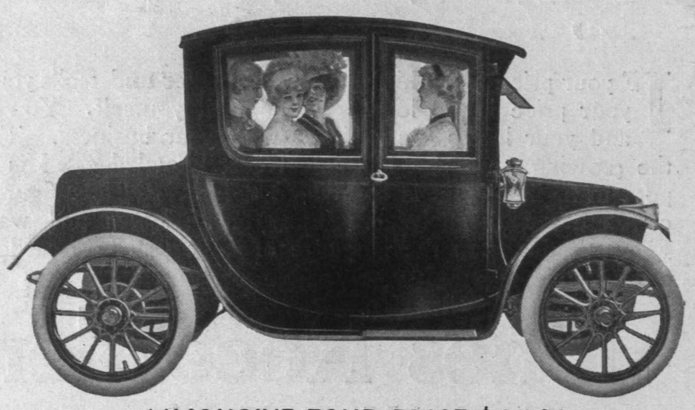

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Four Separate Pullman Chairs Three Facing Forward

—

Full View Ahead Driven from the Left Hand Rear Seat

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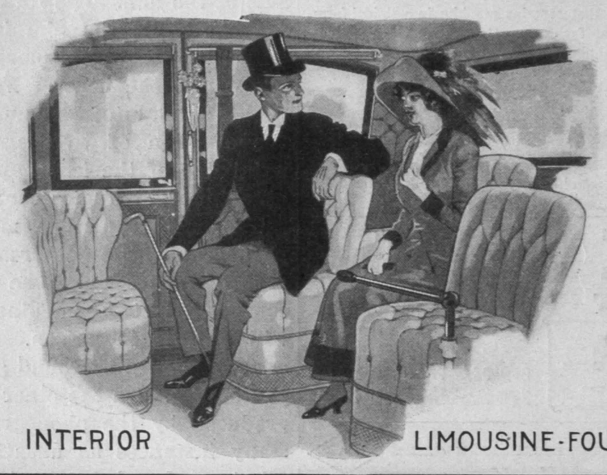
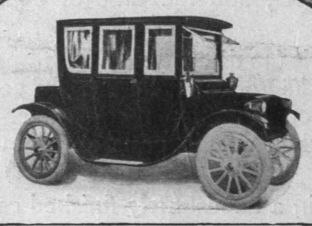


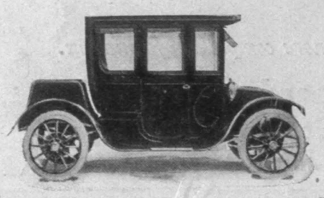
INTERIOR LIMOUSINE-FOUR

How Waverley Experience and Factory Facilities Evolved The Limousine-Four

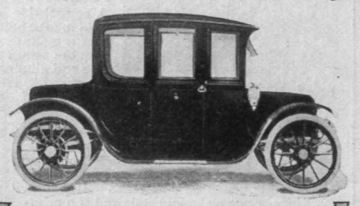
1913



LIMOUSINE-FIVE PRICE $3,500



GEORGIAN BROUGHAM PRICE $3,250



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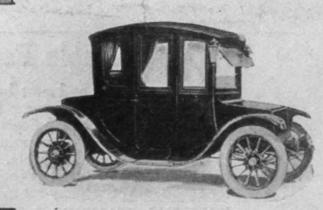
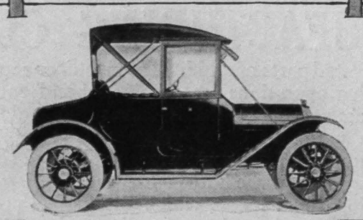


COLONIAL BROUGHAM PRICE $2,375



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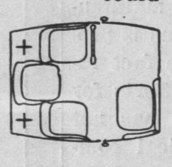
Here is the latest triumph of a company which has originated practically every improvement in electric vehicle construction.

That has factory equipment for the manufacture of every type of electric vehicle, from the smallest runabout or brougham to a mighty five-ton truck—

—And whose experience, gained in the making of this unlimited range of electrics, enable them to evolve this most elegant, comfortable, and convenient of all four-passenger electrics.



Without such experience, and the knowledge gained thereby, such an achievement would hardly have been possible.

It took the company who built the first coupé electric—the first electric with the high efficiency shaft drive—the first electric which could take **either** solid or pneumatic tires—the first electric with full elliptic springs and patented drop sill construction—and the first five-passenger full view ahead electric to originate and design

The Silent Waverley Limousine-Four

In this wonderful car four separate Pullman chairs replace the usual forward and backward seats. Three face forward, the fourth is a "cozy corner" in front at the right.

Thus affording full four-passenger capacity without obstructing the view of the driver, who sits as usual in the left-hand rear seat—the pleasant and sociable position, with, instead of in front of the other occupants of your car.

This arrangement insures ample and delightful spaciousness and absolute freedom from crowding—no crushing of handsome gowns and wraps in the Waverley Limousine-Four—while permitting of greater luxury and greater elegance than has ever before been possible in a four-passenger electric.

The little diagram shows this unique placing of seats, and how golf clubs, parcels, bags, etc., can be stowed out of the way behind the two side chairs. A small item, perhaps, but one that adds greatly to comfort.

Waverley patented drop-sill construction permits of a beautiful, graceful low-hung body swung on full elliptic springs as shown in the illustration—a combination which insures easy riding over every road and with any tires while saving current, increasing mileage and protecting your car from racking bumps and jars.

Batteries are flushed from **outside** the car—no lifting out of cushions with greasy hands, no spotting with water or fabric-eating acids.

The Limousine-Four will be on exhibition at the leading automobile shows, where prospective electric car owners can personally judge of its perfection—

—and decide if such a splendid car, the last word in four-passenger electrics, could have been designed and perfected except by past masters of electric vehicle construction—men who from long experience know the mechanical requirements of every type, from the most luxurious pleasure car to the massive delivery truck.

Let us send you the Silent Waverley Electric Year Book, which illustrates and describes the Limousine-Four, the famous Limousine-Five and the other Waverley pleasure car models illustrated in the left-hand panel.

A beautiful production with decorations by a famous artist—it is yours on request, together with the Waverley Commercial Car Catalog, showing types ranging from a light delivery wagon to a five-ton truck. Address

THE WAVERLEY COMPANY

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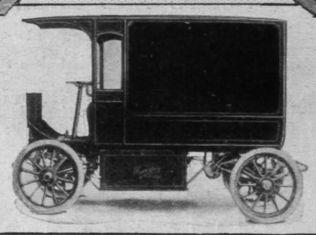

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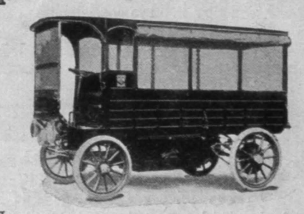

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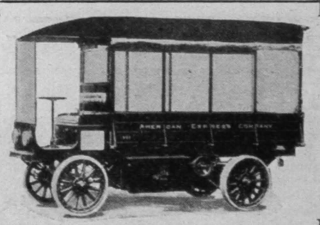
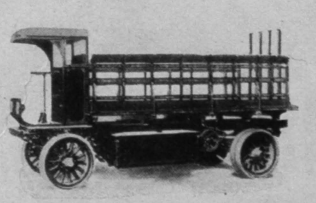
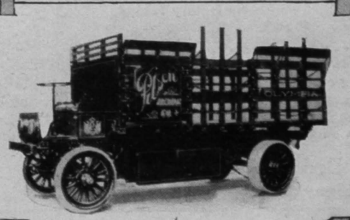


TWO TON TRUCK PRICE $3,250



THREE & ONE HALF TON TRUCK PRICE $3,750



FIVE TON TRUCK PRICE $4,500